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JUN 21 1929

INSTRUMENTS

INDUSTRIAL — SCIENTIFIC

Devoted to the Instrument Problems of all Industries

Vol 2. No. 6 Pittsburgh, Pa. June, 1929

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The Instruments Publishing Company.

The Twelfth Exposition of Chemical Industries.

Conductivity and Hydrogen Ion Measurements.
W. M. GREER, PHILADELPHIA, PA.

Electrical Instruments in the Chemical Industries.
B. P. ROMAINE, NEWARK, N. J.

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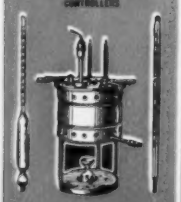

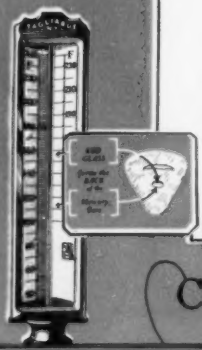

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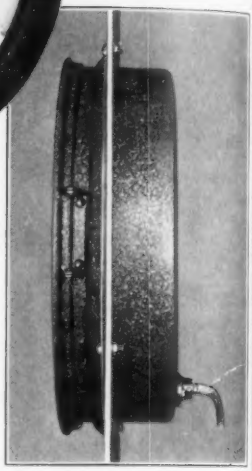

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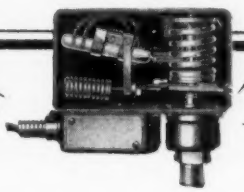

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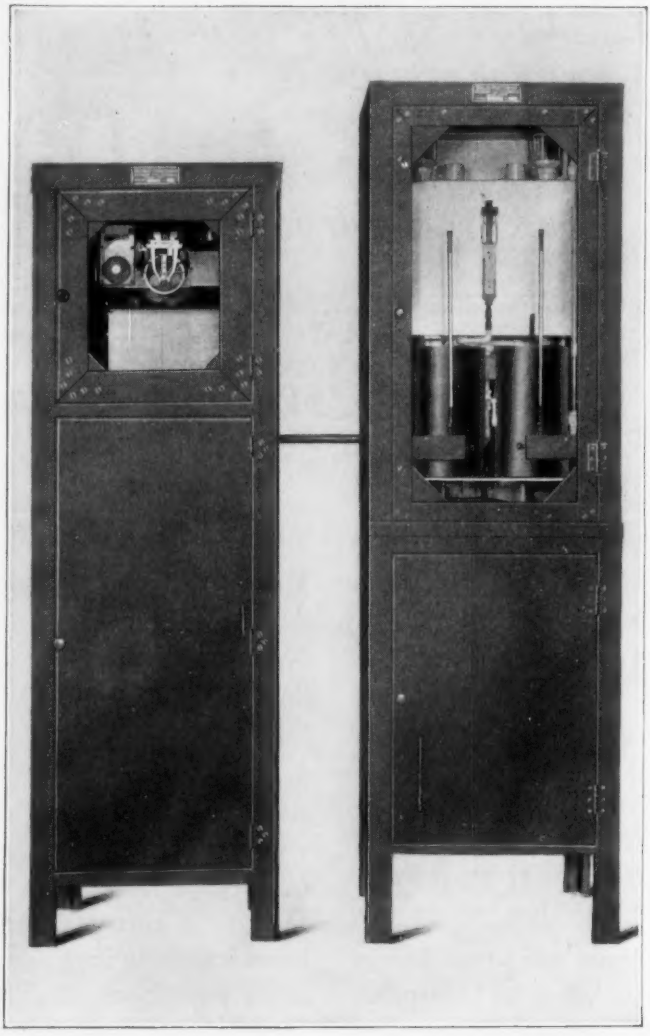

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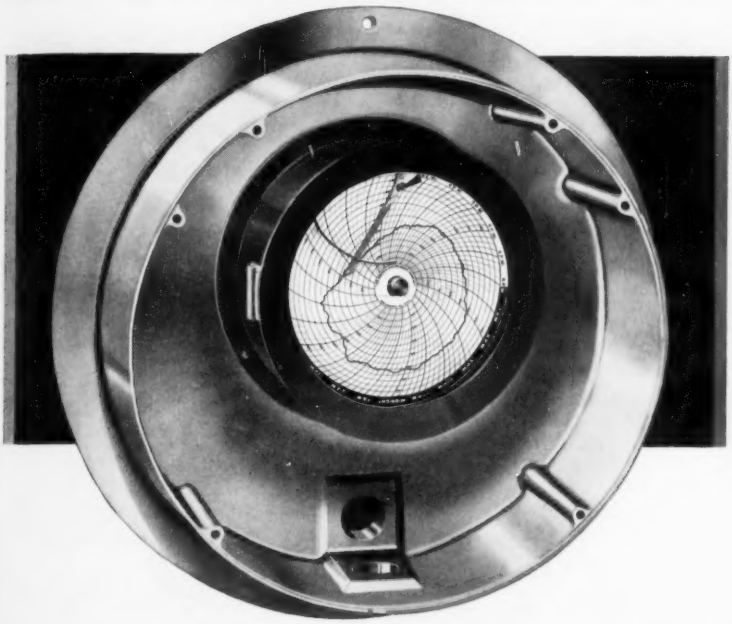

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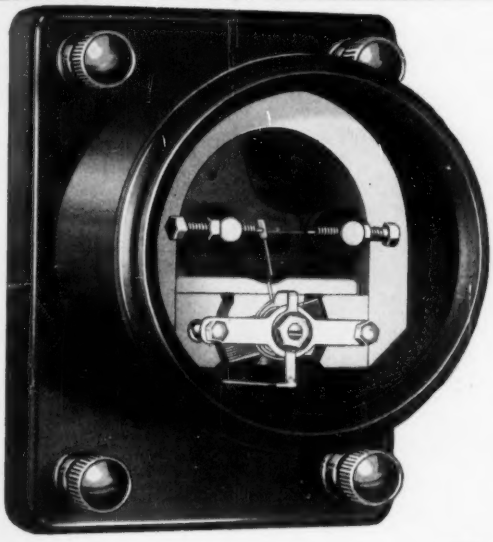

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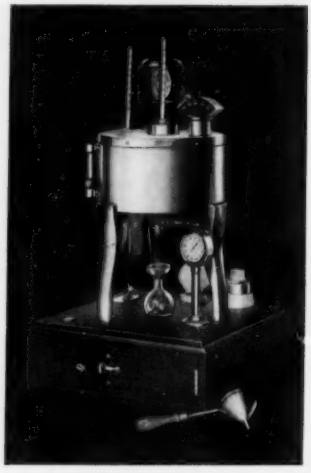

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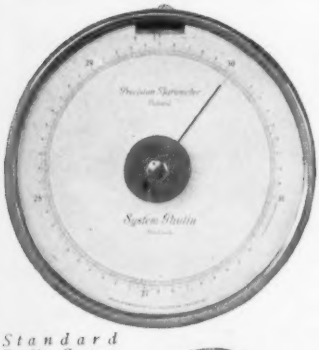

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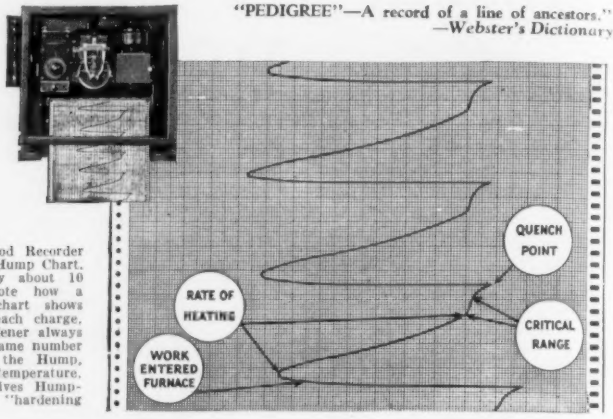

A Hump Method Recorder and portion of a Hump Chart. Chart is actually about 10 inches wide. Note how a Hump on the chart shows the critical for each charge, and how the hardener always quenches at the same number of spaces above the Hump, regardless of temperature. This procedure gives Hump-hardened work a "hardening pedigree."

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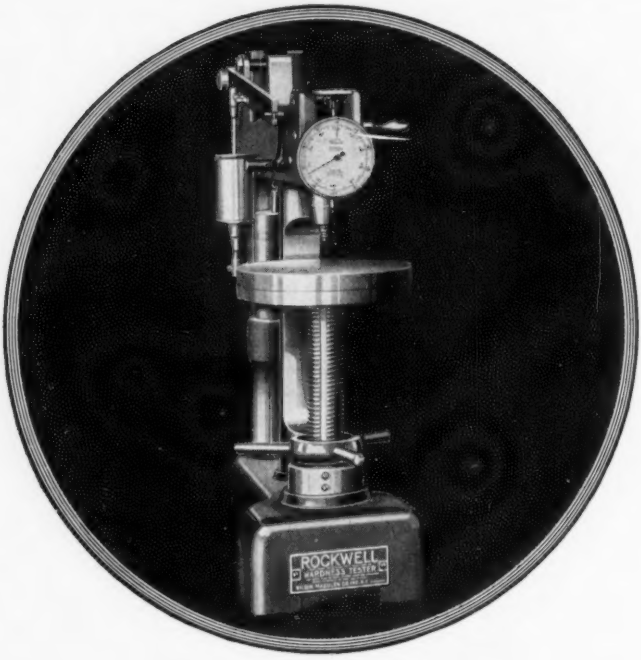
Have your stenographer cut out and mount the index found bound in the back of this issue, listing the principal articles. They will direct you to valuable information to which you may wish to refer in the future.



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INSTRUMENTS

INDUSTRIAL — SCIENTIFIC

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Vol. 2 No. 6 JUNE, 1929 Pittsburgh, Pa.

To Our Readers:

DUE to the fact that the last issue had already gone to press the change in the organization which had taken place could not be announced before this time. This change will reflect a decided improvement in future issues of INSTRUMENTS.

Mr. Joseph J. Vigneau, has replaced Mr. George L. Ray as President and Business Manager of INSTRUMENTS. Mr. Ray is no longer connected with the Instruments Publishing Company. Mr. Vigneau's knowledge and experience in the publishing field will assist the editor in increasing the usefulness of INSTRUMENTS.

We would be very glad to make the acquaintance of all our readers and extend an invitation to all to visit our office at any time. In order to introduce ourselves to you, a short sketch has been prepared and appears in the following pages.

For the Engineer Who Says: "Just the Periodical I've Been Looking For"

AT the Twelfth Exposition of Chemical Industries several engineers urged that a subscription coupon be inserted in INSTRUMENTS which could be detached without mutilating the magazine. Many men, they stated, wish to subscribe after seeing their copy. A detachable form they feel would be a convenience both to them and to the prospective subscriber.

A convenient subscription card will be found in this issue. May it serve its purpose when the next person expresses interest at having made the discovery of INSTRUMENTS on your desk.

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JOSEPH J. VIGNEAU
Business Manager
and
President

RICHARD RIMBACH
Managing Editor,
Vice President and Treasurer

JOSEPH J. VIGNEAU

JOSEPH J. VIGNEAU, President and Business Manager of the Instruments Publishing Company has been active in the industrial engineering publishing field for over 30 years. In 1902 he started the Keystone Consolidated Publishing Company. This Company published:

Mining Catalogue, Coal Edition,
Mining Catalogue, Metals and Quarries Edition,
Coal Buyers' Catalogue,
Keystone Directory of Coal Mines, and
Keystone Directory of Metal Mines and Quarries of the World.

In 1925 overtures were made by the McGraw Hill Publishing Company for the purchase of this company, as the publications issued by the Keystone Consolidated Publishing Company were in line with the new developments they had planned. The final transfer was made on December 28, 1925.

In the next 2 years, Mr. Vigneau traveled very extensively, but after a life time of contact with the industrial engineering publishing field, he felt the urge to return as the other interests which he had acquired were foreign to his life's work.

In August 1927, he heard of the organization, INSTRUMENTS PUBLISHING COMPANY, which was in the process of being formed. He became interested in this company, and very shortly after became a third partner with Messrs. Ray and Rimbach, and INSTRUMENTS appeared for the first time in January 1928. On April 27, 1929, Mr. Ray's share was purchased by Messrs. Vigneau and Rimbach, who now hold complete control of the Instruments Publishing Company as equal partners.

Richard Rimbach, Vice President and Managing Editor of INSTRUMENTS, is a graduate of the Massachusetts Institute of Technology and Harvard University. After a short period in the Engineering

Officer's Training School at Camp Humphreys, he accepted a position in the metallurgical department of the Illinois Steel Company. Twelve months later, he was given the position as Metallurgist in Charge of the Research Bureau Laboratory of the Standard Steel Car Company. After three years with this company, Mr. Rimbach transferred his activities to the Jones & Laughlin Steel Corp., where he worked on operation control problems. One year later he went to the Union Switch & Signal Co., as shop research engineer. Two years later he became instrument engineer with the Bacharach Industrial Instrument Company. He severed his connections with this company in August 1927, to edit INSTRUMENTS.

In addition to his other activities, Mr. Rimbach has written and translated articles for several publications: *Blast Furnace and Steel Plant, Fuels and Furnaces, Heat Treating and Forging, Iron Age, Iron Trade Review,* and the *Rolling Mill Journal.* He has also translated two books: one, entitled the "Theory and Practice of Rolling Steel," the other, "Metallography Simplified for Practical Use In The Shop."

For four years, Mr. Rimbach has been on the faculty of the Carnegie Institute of Technology, as a lecturer in metallurgy in the evening classes. He is a licensed professional engineer of the State of Pennsylvania, and has made a number of translations for use in patent law suits.

———— :: ————

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The Twelfth Exposition of Chemical Industries

PERHAPS one of the most profitable of experiences is that to be gained from attendance at expositions. The Twelfth Exposition of Chemical Industries held at the Grand Central Palace, the week of May 6th was a profitable investment for those who were fortunate enough to be able to attend.

The Exposition was a milestone, which showed the progress made in the so-called chemical industries. While a few years ago the transition from manual control to automatic was but a trend, the day of complete automatism has arrived.

The following report gives information on the various instrument company exhibitors and the products exhibited by them.

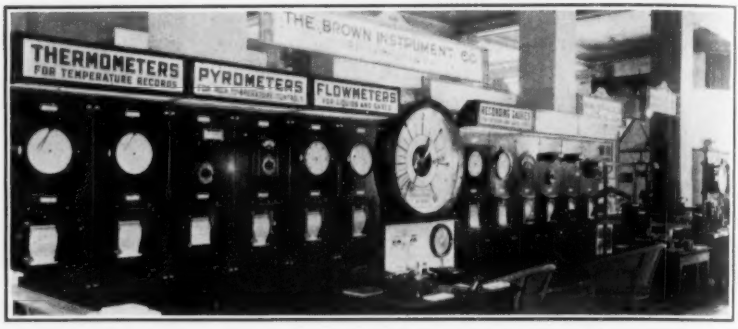
A Selsyn Motor system for the long distance transmission of factors such as liquid level, draft, temperature, pressure, speed, motion, etc., featured the Bailey Meter Company's exhibit. Bailey Meter Automatic Control for pressure, temperature, gravity, flow, and combustion efficiency was demonstrated and a number of photographs, drawings and meter charts from actual control installations were shown. A Bailey Gravity Recorder which continuously records the true specific gravity of liquids was shown with cover off so that the automatic temperature compensating feature of the recorder could be observed. Other equipment exhibited consisted of a Bailey Gas Meter with compensator for pressure variations; a boiler panel with Boiler Meter, Multi-Pointer Gage and Fluid Meter; and an Electrically Operated Fluid Meter.

The Bausch & Lomb Optical Company exhibited various forms of Monocular and Binocular Microscopes, as well as their new Chemical Microscope. Photomicrographic and projection apparatus. Refractometers, Colorimeters, Centrifuges, Quartz Monochromator, Fluoresence Microscope, Magnifiers and Readers, Binoculars and Sport Glasses. Also new Hydrogen Ion Colorimeter and new Universal Spectrophotometric outfit.

Christian Becker, Inc., exhibited the following: Micro analytical balance, sensitivity 1/1000 mg.; Analytical Chainomatic balances, eliminating the use of all riders and fractional weights; Inverted Assay balance, sensitivity 1/200 mg.; Specific gravity balances for the determination of specific gravity of liquids up to 4.0000; and Torsion laboratory scales as well as scales for the textile, paper, dairy and drug trade.

The Bristol Company displayed the following very complete line of instruments: Indicating and Recording Pyrometers with moisture-proof cases, both duplex and single records, and round and strip chart types. Recording Pressure Gauges for pressure and vacuum. Recording Thermometers. Recording Electrical Meters for amperage, wattage and voltage Thermometer Controllers for lower temperatures, with both elec-

trically operated and air operated valves. Thermometer Recorder Controllers. Pyrometer Controllers for higher temperatures, with electrically operated control valves. Pyrometer Test Sets. Air Operated Pressure Controller. Industrial Mercurial Thermometer.



The following flush type instruments were mounted on black metal panels and exhibited by the Brown Instrument Company: Indicating and Recording Thermometers and Pressure Gauges, Duplex Temperature and Pressure Recorders, Strip Chart Recording Thermometers, Indicating Resistance Thermometer so sensitive as to operate when the bulb is clasped in the hand, Strip Chart Recording Resistance Thermometer, Brown Electric Carbon Dioxide Meters in operation, Intermediate and Low Range Manometers, Forged Steel Manometers in various stages of construction, Portable Pyrometers and Potentiometers, Draft Gauges, Thermocouples, Protecting Tubes, Automatic Control Valves and Distant Reading Pressure Transmitter were included in the exhibit.

At the Burgess-Parr Company booth, castings of Illium were shown. This is an alloy developed originally for calorimeter bombs, but which has found extensive applications in industry for handling acids, and other corrosive media. Illium castings are also used to resist oxidation at high temperatures.

Fred S. Carver, Engineers, exhibited a number of laboratory presses for testing and experimental purposes.

The Central Scientific Company and Eimer & Amend showed various scientific instruments and apparatus.

Sigmund Cohn exhibited a complete line of platinum laboratory ware, such as crucibles, dishes, electrodes, etc. Crude platinum, platinum in various stages of refining, and also crude gold, were shown.

Charles Engelhard, Inc., had on display a complete exhibit of analysis equipment for the measurement of industrial plant gases, such as steam ratio analysis, NH_3, CO_2, and one gas in a mixture of other gases, as well as solvent vapor. All of this is accomplished by the use of the Engelhard Quartz Protected Thermal Conductivity Cell. In addition to this, a complete line of automatic packless type solenoid valves and regulating equipment were exhibited.

The Exact Weight Scale Company exhibited their Model 51 scale and their Model 1227 for sacking purposes. Other models for general packing room purposes were exhibited.

The Foxboro exhibit at the Exposition consisted of the following: A Duplex Chromium Plating Temperature- Controller in operation. The new Steam Flow Meter, also in operation. This is of the orifice meter type. It reads direct and totalizes the steam flow as well. An Instrument Board showed Recording and Indicating Thermometers and Gauges, Tachometers, etc.

The Freas Thermo-Electric Company designing engineers and manufacturers of automatically-controlled constant-temperature thermo-electric devices had on display their latest developments in electrically heated industrial ovens in which the temperature is held constant within extremely narrow limits by a thermo regulator of the differential linear expansion type—very simple in construction, positive and powerful in action, and thoroughly dependable. These ovens and dryers have a temperature range from slightly above room heat to 700° F. A large sensitive water thermostat was also on display in which the temperature is maintained constant to the 0.01° C. It may be used for temperatures up to 50° C. The well known Freas laboratory ovens were also there to be examined, and the forced-air-circulation type of oven attracted considerable attention.

The General Electric Company presented an educational exhibit from its research laboratories including streamer discharge, Telsa coil and effects, thyratron tubes, photophone transparencies, a high-frequency furnace, and various photo-electric tube applications. The voice-controlled toy train was included in the display.

The Emil Greiner Company showed: Constant Temperature A.S.T.M. Viscosity Baths to hold two and four Saybolt Viscosimeter Tubes; various oil testing instruments such as Pensky-Martens Flash Testers, Foster Flash Tester, Redwood Viscosimeters, Barbey Viscosimeters, Engler Viscosimeters and A.S.T.M. Pour Test Apparatus; Thermometers of all types including A.S.T.M. Thermometers for petroleum testing; Hydrometers of all types including A.P.I. hydrometers for oil; Stopwatches and stopwatch supports; distillation column for close fractionation and other pieces of lamp blown glassware; precision volumetric ware. Burettes according to U.S. Bureau of Standards, and M.C.A. specifications; thermoregulators and relays; electric heaters and stirrers; Chapman flask for use in latest A.S.T.M. method for determination of surface moisture in fine aggregates, specific gravity of sand and voids in inundated sand.

Hoke, Inc., displayed their reducing valves for oxygen, hydrogen, and other non-corrosive gases; the Flo-gage for administering oxygen to pneumonia patients; the Valvo-gage for compressed gases; the micrometric control for tanks of compressed gases; needle-valves for pipe lines and oxygen blowpipes for city gas plus oxygen, where oxygen is not available it can be arranged for other gases.

The LaMotte Chemical Products Company exhibited their full line of materials and equipment for pH control and for the analysis of water, sewage and industrial wastes. In addition to the standard Roulette and Block Comparators, many new items were shown, such as Indicators, Color Standards and Comparators to cover the pH ranges 0.2-1.8 and 9.6-13.6; the LaMotte Sludge Testing Set; the LaMotte B.O.D. Set; Standards for Water and Sewage Analysis in special sealed Nessler Tubes with polished tops and bottoms; the LaMotte Colorimeter for Nessler Tube Comparison; and a new Chlorine Colorimeter for determining free or residual chlorine in drinking water. In addition a number of new Blood Chemistry Outfits, including Blood Urea, Blood Sugar, Blood Calcium, Icterus Index, Blood Chlorides and Phenolsulfonephthalein Outfits were exhibited.

The Leeds & Northrup Company featured as part of its complete operating display, automatic Conductivity Control, Automatic pH Control, Humidity Recorder, CO_2 Recorder and various types of temperature recorders. It provided an excellent opportunity for those interested to see at first hand the L. & N. recording mechanism.

E. Leitz, Inc. provided for an elaborate display including many constructions which were not shown previously. Among the instruments displayed were: Leitz Metallurscope representing an instrument excellently adapted for metallographic investigations. The equipment being portable, can readily serve for transportation to one or more Laboratories. The Leitz Universal Chemical Colorimeter, offering means for investigation by colorimeter, has many features not evident in constructions manufactured previously. The Leitz "Leica" camera and its accessories enabling one to photograph indoor and outdoor scenes, blue prints, drawings, maps, etc. was shown. Some excellent enlargements which can hardly be identified from original prints, were displayed. A Projector enabling one to project the films taken with the "Leica" Camera proved very interesting since it enabled means for Sales Managers and others to give visual instructions to their sales representatives, etc. A full line of Leitz Metallographic and Polarizing Microscopes were displayed.

The Moto Meter Company exhibited the following: A Model "F-1" Motoco Industrial Thermometer with electric contacts. This is an industrial thermometer which can be equipped with either high or low electric contacts or both high and low electric contacts, which are adjustable. The "T-6" Motoco Industrial Thermometer. This is an extra heavy duty industrial thermometer with a 6-inch case. The "T-1" Transformer Thermometer. This instrument can be made either with or without electric alarm contacts. Model "H" Marine Type Boyce Motometer. This is an instrument designed for use on marine motors. It can be furnished with any length of tubing up to 50 feet.

The Palo Company had on display the following: Palo Acid-alkalimeter for pH determinations (acidity and alkalinity) directly, continuously, and automatically; Daylight Lamps for color matching and general

illumination; New types of balances; Meker furnaces for all temperatures up to 1750° C.; Durieux Filter Paper; Palorium (substitute for platinum); Microscopes and accessories, including photomicrographic equipment; and Ives Tint Photometer for color analysis.

The Pfaltz & Bauer, Inc. exhibit consisted of the line of Scientific Instruments, principally analytical balances, manufactured by the Sartorius Works. Three of the balances represented distinct improvements in their field and attracted considerable attention. The latest model known as the Industrial Rapid Balance was designed specially for the busy industrial laboratory. It is equipped with devices which mechanically handle all weights from the outside of the case and with the improved Air Dampener it is possible to make a weighing accurate to 1/10th of a milligram in less than ½ minute. A much improved Micro-balance was shown with the feature of a completely enclosed beam which to a great extent does away with the trouble caused by slight temperature variations. Another new feature were the Membrane Filters. With these new Filters, seemingly impossible things can be done, such as breaking up emulsions, filtering gasoline out of a mixture of oil, water and gasoline, and many other equally difficult things. The balance of the exhibit consisted of the products produced by E.de Haen such as Fixanal Preparations, C. P. & Industrial Chemicals, and a wide variety of other chemicals manufactured by German concerns.

The Gottfried Automatic Flow Control Co., Inc., exhibited their automatic flow control for water using industries. These controls control the flow of water automatically and have easily operated temperature controls.

Pneumatic Scale Corporation, Ltd., had an operating exhibit. This consisted of six different types of machines used primarily in various branches of the chemical industry, when chemicals or other products in liquid or semi-liquid form are marketed in Fully Automatic Vacuum Filling Machine, a smaller semi-automatic vacuum filling machine, their Samoo Junior, a Single Head Rotary Capping Machine operating with an Automatic Cap Feed; a machine for filling powder into bottles by vacuum, and a Volumetric Pressure Liquid Filling Machine for half-gallon or gallon cans.

The Republic Flow Meters Company, exhibited the new Republic Control Pyrometer described in the new instrument section of the May issue of INSTRUMENTS. The actual control and operation of a small electric furnace and motor operated valve by a Republic Control Pyrometer, without the use of auxiliary relays was shown. The exhibit also included a standard Republic Flow Meter installation, including meter body, orifice assembly and reading instrument.

The Richardson Scale Company showed a "Convey-o-Weigh." This machine consists of two conveyors, one being used for feeding material on to another conveyor. This second conveyor being called the weighing conveyor. When the pre-determined load has been deposited upon

the weighing conveyor, the feed conveyor stops and the weighing conveyor continues and discharges its load. If the supply of material to the "Convey-o-Weigh" should dwindle the scale automatically completes its weighing and then stops until a sufficient supply has again accumulated for another accurate weighing. Under this system it is impossible to obtain inaccurate weights or for the machine to pass material without making a complete and accurate weighing. It is possible to combine two or more of these machines in order to accurately proportion and positively mix any number of materials. An alarm arrangement can be connected with the outfit to give warning when the supply of any material runs low or when the scales have stopped for any reason. In addition to the "Convey-o-Weigh" there was exhibited a Richardson Enclosed Type Dust Proof scale for weighing in bulk or into bags such materials as cynamid, Fullers earth, graphite, linseed meal, castor pumice, whiting, marl, salt, fire clay, boric acid, soda ash, borax, sulphur, pitch, plaster, etc.

Sarco Company, Inc., showed temperature regulators for liquid and dry kiln control. Their apparatus uses the expansion of a thermosensitive fluid hermetically sealed in a tube to operate gas, steam or water valves.

Seederer-Kohlbusch, Inc., displayed a very complete line of precision balances. This exhibition included several new types for weighing, testing, counting, estimating, or for determining percentages. The new Seko No. 60 Analytical Balance, sensitive to 1/20 milligram. All analytical balances on display were equipped with a new style improved type rider carrier, which picks the rider up from the side, and carries it the full length of beam—having an adjustable feature so that the control may be set for riders of any height. Included in this display were assay balances sensitive to either 1/100 milligram, 1/200 milligram or 1/500 milligram; diamond balances with beam graduated 1 carat down to 1/100 carat, and a bullion balance with capacity 5000 ounces, sensitive to 2 grains with full load. Another apparatus was the "Abraham Consistometer," for determining the hardness or consistency of bituminous materials, or any plastic or semi-plastic substance. Among the other testing devices were balances for measuring applied force, either for push or pull, dynamometers for measuring tension, strength, or breaking strain. The Chatillon decimal weigher which weighs in decimals of a pound, giving weight of an article down to 1/10,000 of a pound, without using loose weights. The Kohlbusch estimator, which computes weight of a single unit, showing weight per hundred, thousand, dozen or gross. The Chatillon counting scale with ratio either 10 or 12 to one.

A combination automatic power yarn and cloth tester with a ball burst test apparatus manufactured by Henry L. Scott Company was exhibited in the booth of the U. S. Testing Company, Inc.

The Glass Blowing display of Teschner-Myers Co., Inc. drew attention to the fact that this house has one of the most modernly equipped Glass

Blowing establishments in the industry. In addition to a general line of Laboratory Apparatus and Supplies, this company demonstrated the Teschner "One-Motion" Control Viscosimeter, an oil testing apparatus which has already found favor throughout the Petroleum Industry. The Teschner "One-Motion" Control Viscosimeter was shown in operation in its most improved form. In addition to the Teschner "One-Motion" Control Viscosimeter they also demonstrated the Bacon Bomb Sampler, an instrument used for securing undiluted and uncontaminated samples from the bottom or any desired level of tanks, reservoirs, tank cars or similar containers. Dummies of this company's new catalogs were prominently featured in their display calling the attention of the trade to their new catalogs which are in process of compilation and which are expected to be completed some time during July.

The Vol-U-Meter Co., Inc., showed a constant weight filling device for quantities over five gallons. This apparatus can be installed on any beam scale.

W. M. Welch Scientific Company exhibited the following: Deka-Micro High Vacuum and Pressure Pumps; Hydrogen Ion Apparatus, portable and laboratory form; Trip Scales with Bakelite Pans and Triple Beam Laboratory Balances for speed weighing; 1929 Edition of the Periodic Chart of the Atoms with all recent atomic research data; and a complete line of laboratory instruments.

The Weston Electrical Instrument Corporation was represented by a small attractive display of their electrical measuring instruments. Electro-chemical, laboratory and plant maintenance instruments were grouped and featured were the new Weston Model 539 Miniature Portable Current Transformer and the Model 528 1 Ampere A.C. Ammeter. Weston representatives stated that with these two instruments it was possible to check currents, on lines of commercial frequencies, from 200 milliamperes to 200 amperes, with a guaranteed accuracy of 2%. Many visitors were attracted by the display of a 15,000 ampere shunt for use with Weston switchboard ammeters. Its size and weight were indications of what is necessary to correctly measure high currents accurately.

Carl Zeiss, Inc., exhibited a selection of their optical instruments which are of interest to chemists, for laboratory use as well as for manufacturing control in the plant. The following were specially featured: an extensive line of refractometers, spectroscopes and spectrographs, from small pocket models to spectrographs meeting the requirements for quantitative analysis. Magnifiers covering the entire range of practicable magnifications and working distances. New microscopes for the examination of opaque and transparent objects. Ultra-microscopes for the examination of colloids.

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Books on Instruments and Devices for Measurement, Inspection and Control

NOTE:—Instruments' Book Shelf is prepared to supply any book or periodical.

ELECTRICAL MEASUREMENTS IN PRACTICE. F. Farmer. 1917. Cloth, 360 pages, $4.50 postpaid.
ELECTRICAL METERS. C. Jansky. 1917. Cloth, 416 pages, $4.00 postpaid.
THE THEORY OF MEASUREMENT. A. Palmer. 1912. Cloth, 248 pages, $3.00 postpaid.
METHODS OF MEASURING ELECTRICAL RESISTANCE. E. Northrup. 1912. Cloth, 380 pages, $4.50 postpaid.
CONNECTING AND TESTING DIRECT-CURRENT MACHINES. F. A. Annet and A. Roe. 1925. Cloth, 237 pages, $2.50 postpaid.
LIGHT, PHOTOMETRY AND ILLUMINATING ENGINEERING. W. Barrows. 1925. Cloth, 412 pages, $4.00 postpaid.
CIRCUIT TROUBLES AND TESTING. T. Croft. 1924. Cloth, 224 pages, $2.50 postpaid.
PRACTICAL USES OF THE WAVE METER IN WIRELESS TELEGRAPHY. J. Mauborgne. 1913. Cloth, 74 pages, $1.25 postpaid.
ENGINE ROOM CHEMISTRY. A. Gill. 1923. Cloth, 174 pages, $2.00 postpaid.
STEAM ENGINE INDICATOR. F. R. Low. 1910. Cloth, 169 pages, $2.00 postpaid.

Electrical Instruments in the Chemical Industries * *

B. P. Romaine *

THAT the relation between electricity and chemistry is a close one need hardly be mentioned. In fact one of the earliest ways of generating electricity was by chemical means, and the galvanic battery still holds an important place in the electrical industry. Obviously where electricity is used it must be controlled and measured if its full benefits are to be realized.

Voltmeters and millivoltmeters directly indicate the voltage across their terminals. In general, this type of instrument draws current from the circuit to which it is connected. When the external circuit has a resistance which is appreciable in comparison with the resistance of the meter a fall of potential in the external circuit takes place when the meter is connected. This results in a lower indication on the meter than the true open circuit voltage. Frequently the resistance of the external circuit is unknown or variable so that correction for its effect upon the meter readings is impracticable. In such a case the potentiometer would be resorted to for undirectional voltages. In this device the unknown E.M.F. is balanced against an adjustable E.M.F. until both are equal. Equality is shown by the absence of current flow between the source of E.M.F. and the potentiometer. When this condition exists there is no fall of potential in the external circuit regardless of its resistance, and hence the setting of the potentiometer indicates the true open circuit E.M.F. of the external circuit.

A balance between the E.M.F. of the potentiometer and external circuit is indicated by an instrument called a galvanometer. This device simply deflects from its normal or zero position when current is passed through it, the direction of deflection depending upon the direction of current flow. Absence of deflection indicates absence of current.

Ammeters and milliammeters are used to measure current strength. If their resistance is not negligible in comparison with that of the rest of the circuit their presence causes an appreciable increase in the circuit resistance and hence a smaller current flows than would exist if they had not been inserted in the circuit. This may or may not be a disadvantage depending upon circumstances.

For measuring electrical resistance the Wheatstone Bridge is frequently employed. This consists of the unknown resistance to be measured, three resistors of known value, a source of E.M.F. and some form of current detector such as a galvanometer. When certain known relations exist between the values of the unknown and known resistors no

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current will flow through the galvanometer and the value of the unknown resistor can readily be calculated. Commercial forms of Wheatstone Bridges are either direct reading or the calculation only involves multiplying the dial readings by a simple factor like, 10, 100, 0.1 etc. In bridge measurements of solutions polarization would occur if a direct current were used, hence it is necessary to employ an alternating current source and some form of alternating current detector such as a telephone receiver.

Wattmeters are used to measure the total electrical energy delivered to a piece of apparatus, for example, an electric furnace.

For measuring low or moderate temperatures the resistance thermometer is a useful instrument. It is based upon the change of resistivity of some such metal as platinum, nickel, etc. with temperature change. The resistance unit is exposed to the temperature to be measured and the resistance is indicated by a Wheatstone Bridge or any one of several forms of resistance measuring instruments which may be calibrated directly in temperature. Several resistance units located in widely separated locations may be successively connected to one conveniently situated temperature indicator.

Higher temperatures are readily measured by electric thermo-couples connected to either a d.c. millivoltmeter or to a potentiometer. Such a combination is called a pyrometer. The thermo-couple consists of two suitable dissimilar metals, the junction of which is exposed to the temperature to be measured and the cold end is either maintained at a known temperature or some form of compensating device is provided for correcting for cold end temperature variations. An E.M.F. is set up in the couple which depends upon the difference in temperature between the hot and cold ends, hence the generated voltage is a measure of this temperature difference and the millivoltmeter or potentiometer may be calibrated to read temperature difference directly. If a fixed cold end temperature is maintained or a compensator for cold end variations is provided the calibration may be made directly in degrees of any temperature scale such as Fahrenheit or Centigrade.

In commercial chemical processes such as mixing or agitating it is sometimes desirable to measure speed. This may be done by connecting a small direct current electric generator called a magneto to the driven device and measuring the voltage produced by means of a direct current voltmeter. The magneto consists of a permanent magnet in the field of which a small armature is free to rotate. The current is collected by means of a commutator and brushes which are often made of silver to insure good electrical contact. The voltmeter may be calibrated in revolutions per minute, feet per minute, or other appropriate units.

The various kinds of instruments mentioned may be made to simply indicate on a scale the quantities they are designed to measure, or they may record them on a chart which moves at a predetermined speed by clock work or otherwise. The chart is frequently ruled in hours and

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fractions of an hour so that the recorder shows the conditions existing in a process throughout the working day, thus not only may operators see at any instant what conditions exist but also supervisors are provided with a permanent record of what has taken place.

Before mentioning any of the uses, the various electrical instruments mentioned may be put to by the chemist, let us assume that their indications really are of value in disclosing chemical conditions in many processes.

If this is true, which it undeniably is, then operators in chemical manufacturing plants may use electrical indicating and recording instruments to guide them in manually controlling processes.

Having gone this far one naturally asks the question: Why not use the indications of these instruments to directly actuate the various controls and thus dispense with the expense and uncertainity of manual control? The answer is that it can be and is being done.

Most indicating and recording electrical instruments are of delicate construction and their movable parts cannot directly open and shut valves and perform similar tasks. Indirectly they can do so in many ways. Sometimes indicating electrical measuring instruments close electrical contacts when the indications are a given amount above or below predetermined values. The closing of the high and low contacts may cause electric currents to perform exactly the same operations that an operator would perform with manual control. Such instruments are commonly called "Contact making instruments." In general, they possess one characteristic which is frequently a disadvantage. That is, the indications are limited to the region between the upper and lower contacts which prevent further motion so that if the automatic control fails, or over rides, no indication of this is secured.

For this and other reasons connected with design difficulties it is frequently better to use indicating or recording instruments to show what is taking place in a process and employ another device for opening and closing the electrical circuit when the feeble currents resulting from incorrect process conditions become too large or too small. Such a device is called a relay. Relays may be constructed to operate on current variations, voltage variations, wattage variations, etc. They may also be made for both alternating and direct currents.

Beside closing or opening electrical circuits the pointer of an electrical measuring instrument may be made to control powerful mechanical motions or large amounts of electrical energy in various other ways without interfering with its normal function of indicating or recording. A description of any of these ingenious schemes would be beyond the scope of this paper.

Let us now see some of the uses to which the chemist has put the various electrical instruments which have been described.

Electro-plating is a familiar example of an electro-chemical process. Here direct current is used and it is necessary to maintain the correct

voltage and current density for the metal being deposited, hence direct current ammeters and voltmeters are employed.

This is a specialized industry in which comparatively few chemists are interested in so far as it serves to simply coat objects with a metal for protection, improving appearance or the like. There are, however, a number of instances where the electrical deposition of metals are of vital interest to the chemical research worker as well as the industrial chemist. One of these is in quantitative analysis. Generally speaking each metal has a critical voltage below which it will not be deposited from a solution.

If it has been determined by qualitative analysis that a solution contains two or more metallic salts having sufficient difference in decomposition voltage these may be successively deposited on a platinum cathode by first applying a voltage corresponding to the salt having the lowest decomposition voltage and then raising the voltage to that of the next higher salt, taking each in turn. The quantity of each metal can then be determined by weighing the cathode. For this determination a d.c. voltmeter is necessary for measuring the voltage and an ammeter should be used for maintaining the correct current density in the solution.

This is only a very meager description of the process of quantitative analysis by electrolysis but serves to illustrate the principle involved. In analyses where solutions are electrolyzed in order to bring about chemical reactions prior to depositing the metal, electrical measuring instruments also find a use.

An industry of great commercial importance is the electrolytic refining of copper. Here practically pure copper is deposited on the cathode and the impurities are largely deposited in the bottom of the tanks as an insoluble mud. The correct maintenance of suitable values of current and voltage is highly important and hence direct current ammeters and voltmeters are employed for this purpose. Ammeters and voltmeters are also used in various other electrolytic processes such as extraction of gold, silver, refining of zinc, tin, nickel and many other metals, the evolution of hydrogen gas and the precipitation of copper oxide.

Another important field of use for ammeters and voltmeters is processes involving the use of fused electrolyte. The manufacture of aluminum is an example of several processes of this kind. In fact the uses to which ammeters and voltmeters are put in commercial and laboratory chemical operations are too numerous for enumeration.

In analysis, such as determination of carbon by direct combustion and in a multitude of other instances the temperature of electric furnaces must be measured and controlled. An electric pyrometer consisting of a suitable thermo-couple connected to a sensitive millivoltmeter or to a potentiometer may be used for this purpose. An ammeter in series with the furnace is also a convenience as the user will quickly find approximately what currents are required to bring the furnace up

to various temperatures in a reasonable time and also what currents will maintain these temperatures. Electrical pyrometers and resistance thermometers are indispensable in innumerable other instances where temperature measurements must be made.

The Kelley Electrometric Titration Apparatus is an interesting and important application of an electrical measuring instrument to chemical analysis. In this apparatus the end point of titration is indicated by a sudden change in the difference of potential between a platinum electrode and a calomel electrode in the solution, the voltage being measured by means of a potentiometer.

A galvanometer or voltmeter may be used to detect the sudden change in voltage at the end point but owing to the high resistance of the solution the actual voltage would not be indicated accurately. When an accurate voltage measurement is valuable in showing just what conditions exist, the potentiometer is chosen because it draws no current, and hence variations in resistance of the solution have no effect upon its indications. For the same reason a potentiometer is also used in connection with hydrogen and calomel electrodes to measure the hydrogen ion concentration of solutions.

Although the production per day of many commodities is directly proportional to the speed, either rotational or lineal, of the machinery used in their manufacture and quality is often vitally affected by it, the measurement of speed has for some unaccountable reason been sadly neglected. There has, however, been a marked change in this respect during the past few years and the electric tachometer is rapidly being applied to a great variety of machines where the maintenance of correct speed is advantageous. These instruments may be calibrated in revolutions per minute, feet per minute, units produced per hour, etc. and possess the advantage that more than one indicator, or a recording instrument and one or more indicators, can be connected to a single magneto and located at various convenient points.

The electrical resistance of a solution is frequently a reliable indication of its concentration. Since the resistance of solutions is generally dependent to a marked degree upon their temperatures the effect of temperature cannot be neglected. Of course solutions to be measured for resistance could always be brought to a standard temperature but this would introduce undesirable complications. When a solution is to be maintained at a constant concentration a standard solution of the same kind can be made, enclosed in a glass tube and immersed in the solution to be kept constant. Both solutions are thus maintained at the same temperature and hence if they have the same concentration they will have the same specific resistance. If these two solutions are used as two arms of a Wheatstone bridge, operated on alternating current to eliminate the effects of polarization, no current will flow through the galvanometer when a balance of resistance exists. If unbalance occurs due to variations in solution concentration this will cause deflec-

tion of the galvanometer and this deflection may be indirectly utlized to add to or subtract from the solution concentration. By this means concentration can be automatically controlled. Of course some form of alternating current galvanometer is necessary or the current in the galvanometer circuit must be rectified if a direct current galvanometer is to be used.

In laboratory investigations it is also frequently required to measure the specific resistance of solutions and similar apparatus minus the automatic control feature may be employed. In this case head phones are usually used in place of a galvanometer.

In chemical processes involving the use of large amounts of electrical energy watthour meters are installed to determine the total amount of power consumed. This makes it possible to determine the amount of material produced per kilowatt hour and thus efficiency of production can be checked. This is naturally a help in maintaining a plant in the highest possible state of efficiency and is very important where the cost of electrical energy is a large factor in total production costs.

There are many other electrical measuring instruments which are of great value in locating sources of power waste, forestalling electrical failures and in general maintaining the electrical equipment in an efficient state.

An important fact for the chemist to bear in mind is that to a great extent the adaption of electrical methods and instruments has in the past and will in the future be brought about by the chemist and not by the electrical engineer. Naturally the design details of the electrical apparatus used can best be worked out by electrical manufacturers but the basic principles involved are for the chemist to discover. In order to extend the splendid work which has been done, and to make full use of what has already been accomplished by others, the chemist of today should be provided with the best electrical equipment which has been developed for his needs and familiarize himself with its use.

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It is less than a year since The Brown Instrument Company completed the construction of a two-story addition to its plant, yet the continued rapid growth of the company's business has necessitated another addition to the present buildings.

An existing one-story wing of the plant will therefore be demolished at once, and a new two-story and basement building will be erected on the site. Also a new central wing of two stories and basement will be constructed.

The new buildings will increase the floor space of the plant about 50 percent. This added space will provide larger facilities for receiving, shipping and handling material, also affording more room for manufacturing and research. The above project will be the fourth addition The Brown Instrument Company has made to its plant in eight years.

Conductivity and Hydrogen Ion Measurements**

W. N. Greer*

Introduction. This paper is presented for the purpose of suggesting the use of electrometric equipment as a means of studying, and the possibility of controlling, various processes in the pulp and paper industry. The large number of papers which have been published on pH measurements indicate the interest and value of such measurements. Conductivity measurements do not appear to be as widely used as do pH measurements, although where applicable they afford a very convenient means of control. The material contained in this paper, although not complete, gives an indication of what may be accomplished along these lines.

Conductivity Measurements. It is probably generally understood that an electrolytic resistance or conductance measurement is a measure of the concentration of dissolved salts present in a solution. The word "salts" is here used in the broader sense, meaning acids and bases, as well as the common conception of salts. As the concentration of salt increases, the conductance increases, or the resistance decreases. In order to determine the applicability of such measurements to the sulphite cooking process and the subsequent washing of the pulp, as well as the washing of soda pulp, a few measurements were made on such processes during a regular plant operation. The data presented are not complete, since the author did not feel justified in asking the plant management to modify their process in order to obtain the additional data. It is hoped, however, that the material presented will sufficiently interest those concerned as to carry the work to a more definite conclusion.

Sulphite Cooking. In Fig. 1 are plotted the data obtained on measurements of a sulphite cooking liquor during the process of digesting. The specific resistances are plotted as the ordinate, and the time in hours as the abscissa. A smooth curve was not drawn through points plotted, since it could not be assumed that a uniform change took place.

It will be noted that the resistance increased more or less uniformly during the first 9½ hours of digesting. After the lapse of another hour it was found that the measured resistance was almost identical with that measured an hour previous. If values had been obtained during this one hour period it would probably have been found that a fairly sharp maximum would have been exhibited. A rather marked decrease resulted in the last one-half hour of digesting.

*Leeds & Northrup Company, Philadelphia, Pa.
**Paper read before Students' Course at Twelfth Exposition of Chemical Industries.

The initial increase in resistance was probably due to the conversion of inorganic salts to organic. The final decrease in resistance might have been due to the formation of some compound such as acetic acid which is a better conductor than the complex organic substances. A better explanation could no doubt be offered by chemists much more familiar with this industry than is the writer.

The point of particular interest is that if similar curves generally are obtained in the sulphite digesting, conductivity measurements might well afford a means of following this process.

Washing of Sulphite Pulp. Before making any measurements on the washing of pulp, the writer assumed that a gradual increase in resistance would initially take place, with a more marked increase toward the end of the wash, and finally that the resistance would approach a constant value, tending toward that of the wash water used.

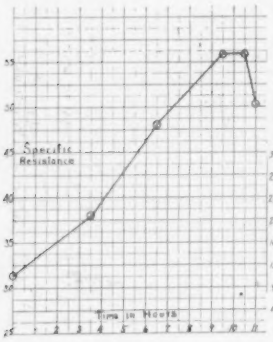

Fig. 1

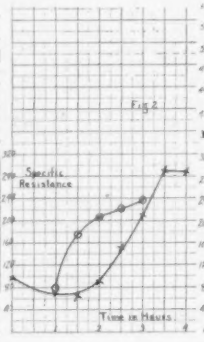

Fig. 2

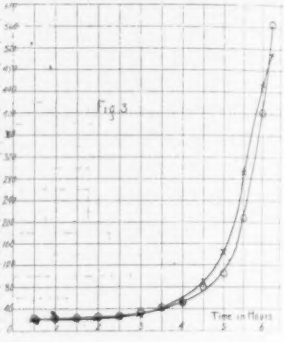

Fig. 3

In Fig. 2 are plotted curves from data obtained in the washing of two charges of sulphite pulp. In the curve indicated by the crosses the above assumption was in part fulfilled, but a marked "break" was obtained at a fairly low resistance value. The specific resistance of the wash water was 12,000 ohms. The second curve differs considerably from the first yet was approaching it at the end of the wash. It would have been interesting to have continued washing this charge for another hour or two in order that it might have been more favorably compared with the first curve.

Due to the final low resistance, as compared with that of the wash water, it would seem that those charges were not sufficiently washed.

Washing of Soda Pulp. In Fig. 3 are plotted curves from data obtained on the washing of two charges of soda pulp. It will be noted that the curves more or less coincide, and further, that insofar as the washing was carried the anticipated type of curve was obtained. The resistance was increasing rapidly and in a short time would undoubtedly have approached that of the wash water, indicating a thorough washing.

Portable Conductivity Indicator. The instrument used in making the above measurements is illustrated in Fig. 4. This instrument is a portable, self-contained Wheatstone Bridge and operates from 110 volts 60 or 25 cycle source. The resistance range which can be covered is from .3 to 30,000 ohms. It affords a convenient instrument for both laboratory and plant use.

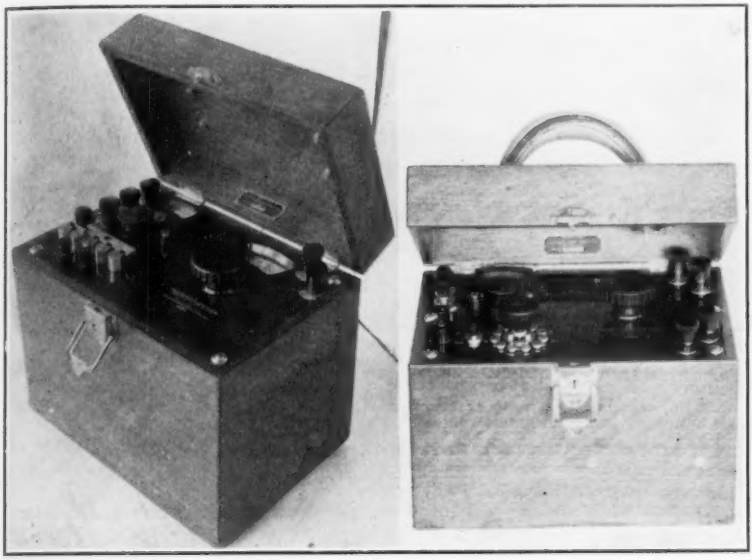

Fig. 4

Fig. 5

Hydrogen Ion Measurements. pH measurements are now quite generally used in the paper industry. In Fig. 6 is illustrated a pH indicator designed especially for use with the quinhydrone electrode. The instrument is calibrated in millivolts with a range from −400 to +100 millivolts, which with the quinhydrone electrode corresponds to a pH range from about 1 to 9. The accuracy of this indicator is 2.5 millivolts, or .04 pH unit.

The quinhydrone electrode is applicable to solutions which are not more alkaline than 9 and which do not contain highly oxidizing or reducing substances.

A modification of the quinhydrone electrode is available which allows of continuous measurements on flowing solutions within the range of the quinhydrone electrode and which do not contain an appreciable amount of suspended material. Suitable arrangements can be made to obtain continuous pH measurements on such waters as white water from paper machines.

In Fig. 5 is shown a self contained portable potentiometer, which can be used with any type of electrode. This is a very convenient po-

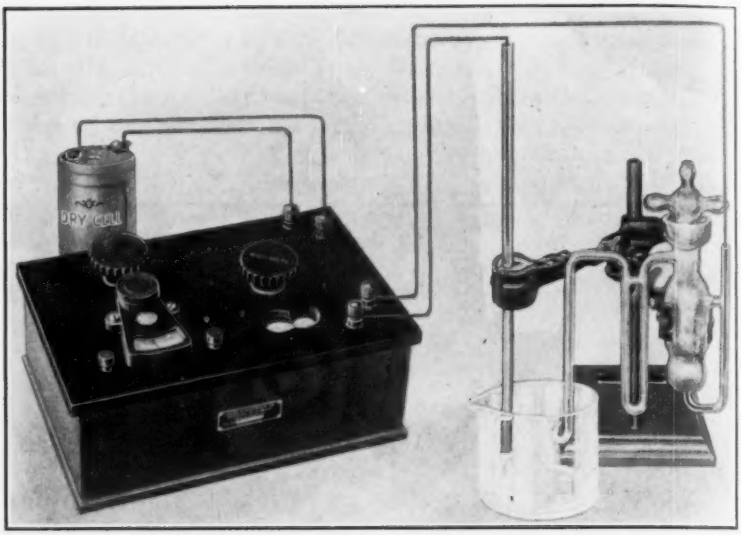

Fig. 6

tentiometer in the laboratory, and particularly in the plant where it is desired to make a number of measurements at various points.

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The Brown Instrument Company has moved its Boston office from 161 Devonshire Street, Boston, Mass., to 1107 Public Service Building, 89 Broad Street, in the same city. This change has been made necessary by the need of larger quarters due to the rapid growth of the company's business in the New England territory.

Due to the constantly increasing volume of business in the Pittsburgh district, the Pittsburgh office of The Brown Instrument Company has moved to larger quarters. It is now located at 1522 Oliver Building. While the former office was also located in the Oliver Building, the new quarters offer increased facilities for handling the new business.

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The Pioneer Instrument Company, Brooklyn, N. Y., have opened a Service Department at the Chicago Municipal Airport, 5034 West 63rd Street, Chicago, Ill.

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Offices of the Westinghouse Electric and Manufacturing Company in Pittsburgh, Pennsylvania, are now located in the Grant Building. The sales offices occupy the entire eighteenth floor and the offices of the chairman of the board, the Westinghouse Lamp Company and the Westinghouse Electric Elevator Company occupy half of the nineteenth floor.

New Instruments

Recently Developed by Instrument Manufacturers

Write Information Section, Instruments Publishing Co., Pittsburgh, Pa., for additional information.

New Recording Gas Calorimeter

THE Burgess-Parr Company Recording Gas Calorimeter is the result of many years of research by Prof. S. W. Parr, combined with several basic features developed by the Doherty Research Company. It is an instrument that can be used to determine the calorific value of coal gas, water gas, natural gas, producer gas or mixtures of these gases.

The determination of heating values of gas through heating a given quantity of water by the combustion of a given volume of gas was accepted long ago by the gas industry. The necessity, however, of weighing water and metering the gas in order to make the calculations has limited this fundamental method to hand operated instruments. The need of a continuous and recording instrument of this same general type has become particularly urgent, not only to manufacturers, but also to large industrial users of gas.

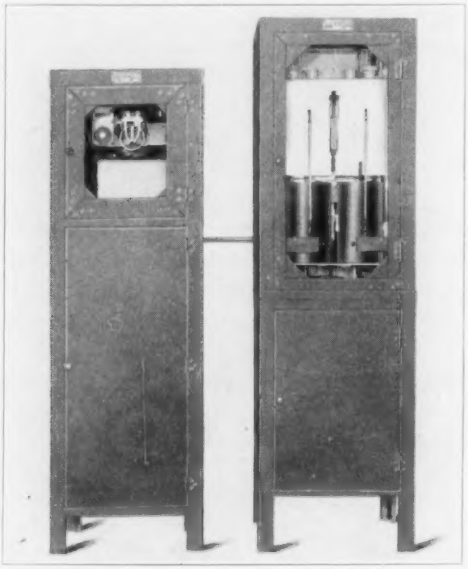
The Burgess-Parr Company Recording Gas Calorimeter is an instrument of the flow type, in which a continuous flow of water is used to absorb the heat of combustion of a continuous flow of gas. In order to maintain the continuous flow and relative volumes for water and gas, two sets of measuring chambers are used which fill alternately with water and gas. In this way the water which displaces the gas during one cycle, absorbs the heat produced by the combustion of the gas during the following cycle.

The reversal of flow for each cycle is effected by turning one master valve through an arc of ninety degrees each time the gas measuring chamber connected to the burner is exhausted. By means of this master valve, measured volumes of gas are automatically delivered to the burner, and measured volumes of water, to the heat extracting chamber. This two cycle operation is continuous and the flow of gas and water is not interrupted.

The temperature of the water before and after leaving the heat extracting chamber is measured both by electrical resistance thermometers and precision mercurial thermometers. The temperature differential between the electrical resistance thermometers is recorded by a Leeds and Northrup temperature differential recorder and the reading is given direct in B.T.U.'s per cu. ft. The mercurial thermometers are located in such a position that they may be observed

easily at any time as a check on the proper adjustment of the recorder. The calibration of the instrument is such as to make each degree of temperature differential equivalent to one hundred B.T.U. per cu. ft.

The water, after passing the thermometers at the outlet of the heat extracting chamber, flows to a tank in the lower section of the calorimeter where it is cooled to its original temperature by a small stream of cooling water, the flow of which is thermostatically controlled. The water, after being cooled, is then pumped to the upper tank where it is used for bringing the gas to an exact temperature, and for displacement of gas in the measuring chambers.



The important features of this calorimeter, in addition to its entirely automatic operation, are the ease with which it may be adapted to gases of any heating value, and the small lag or period of time required for the recording of the complete change in heating value of the gas. In accuracy, the instrument is comparable for single readings to hand operated instruments using a similar principle of operation but considering the freedom from metering and radiation errors and the continuous operation of the instrument, the overall accuracy for any period of time is greatly increased.

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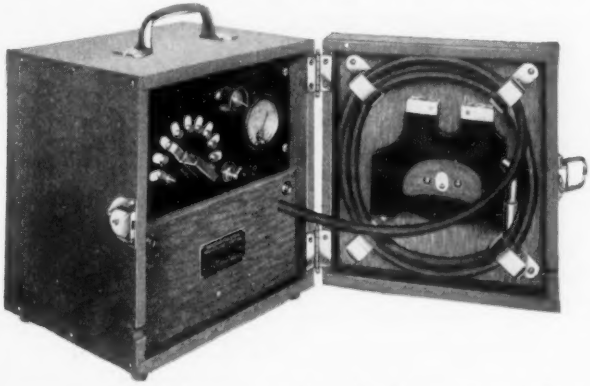
The Westinghouse Electric and Manufacturing Company announces the removal of its Pittsburgh Sales Offices to the Grant Building, Fourth Avenue and Grant Street, Pittsburgh, Pa.

New Moisture Meter

(C. J. Tagliabue Mfg. Co.)

THE advantages of properly seasoned lumber are well known by all who use it, but it is impossible with present methods of seasoning to dry all boards uniformly. The need has been for an instrument that could sort out the slow drying stock and then re-dry it or



use it for purposes that do not require the lower range of moisture content.

The Tag-Heppenstall Moisture Meter has been designed to make accurate and rapid determination of the moisture content of wood. Its operation is based on the measurement of electrical conductivity.

After two years of testing and developing a thoroughly practical and accurate instrument has been developed. The calibration is based on tests of thousands of samples of rough and dressed western fir boards one to two inches thick, with various moisture contents, and densities. Small corrections may occasionally be necessary for some woods, which may easily be determined.

The portable Tag-Heppenstall Moisture Meter is contained in a carrying case and is complete with batteries and testing handle. An

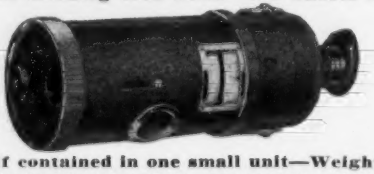
essential part is the insulated handle attached by a flexible cable eight feet long. This handle holds needles for contacting with the boards, and a small lamp to indicate the moisture content. On the panel of the instrument there is mounted a meter and a rheostat to control the set throughout the useful life of the battery. A selector switch is also located on the panel with a dial calibrated in percentage of moisture content.

The instrument can be used in two ways: (1) for the selection of lumber under a certain moisture content, or (2) to determine the actual moisture content of individual pieces.

In order to determine the actual moisture content of a board the handle is pressed into the board and the selector dial turned until the light flashes in the handle. The selector dial then indicates the moisture content.

A few of the advantages of this method of measuring moisture content are as follows:

1. The instrument is rugged and portable.
2. The moisture content is indicated immediately.
3. Calculations are not required.
4. Can be used by an unskilled workman.
5. Lumber is not destroyed or injured in the test.
6. Every board in the shipment can be tested.
7. Several tests on an individual board can be used to study the variation in moisture content.
8. Moisture gradients can be determined rapidly by sawing off a piece of board and testing the end section at different points on the cross-section.
9. Lumber can be tested in use. This is of great advantage in determining use requirements.

PYRO OPTICAL PYROMETER
With Direct Reading Iron Scale—No Charts to Consult
Easy to Use. Accurate Economical

Practically automatic in operation.
Entirely self contained in one small unit—Weight 3 pounds.
THE PYROMETER INSTRUMENT COMPANY
50 Howard Street New York, N. Y.

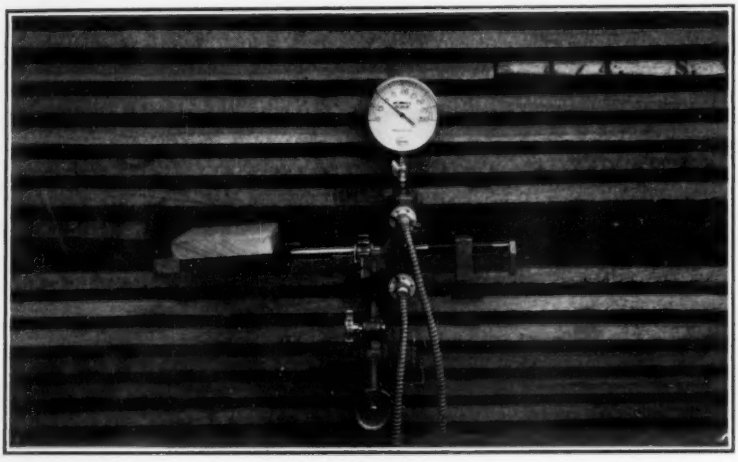
The Kiln Boy

(The Foxboro Company)

THE Automatic Kilnboy consists of three instruments together with the necessary auxiliary equipment. (1) Kilnboy Scale, (2) Humidity Recorder-Controller fitted with pneumatic set works, and (3) Moisture Content Gauge.

The Kilnboy scale shown in the photograph is a pneumatic scale the operation of which is similar to an adjustable air-pressure reducing valve. It is placed in the air line between the air supply and the pneumatic set works. The weight of the moisture in the sample regulates the air pressure—the more moisture present the higher the pressure. As the sample loses moisture the scale automatically reduces the air pressure.

The moisture content gauge records this loss of pressure in terms of moisture content.

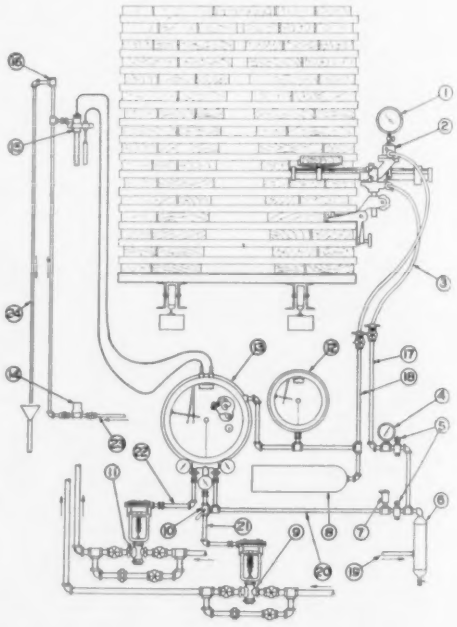


The pneumatic set works is a cam-setting device inside the humidity recorder-controller case. It is operated by a clock spring mechanism and controlled by the air pressure from the Kilnboy scale. As the air pressure is reduced by the loss of moisture in the sample the set works automatically reset the drying schedule cams which in turn reset the control points on the humidity recorder-controller.

To operate is a simple matter. When stacking one of the cars, a board, or boards, is left out of the middle of the stack in the usual manner, to allow the sample to rest within the stack. This will insure the same rate of drying for the sample as for the rest of the lumber. The Kilnboy is then clamped on the side of the pile and the car rolled into the kiln. The flexible air hose is attached by quick detachable

couplings to air risers in the kiln, and the air turned on. With the air on, the scale pan adjusting nut is turned backward or forward until the indicating gauge on the Kilnboy scale shows the moisture content of the sample corresponding with the original test. The set works are then set to the same moisture content, and the remainder of the drying process is automatic.

The diagrammatic layout below graphically illustrates the simplicity of the standard method of installing the automatic Kilnboy.



The humidity recorder-controller (3) and the moisture content gauge (12) are located at some convenient point, preferably in the operating pit. If desirable, the moisture content gauge may be located in the engineer's office.

The wet and dry bulbs and the water-box (15) are located on the kiln wall at a point where the circulation is representative of the average condition in the kiln.

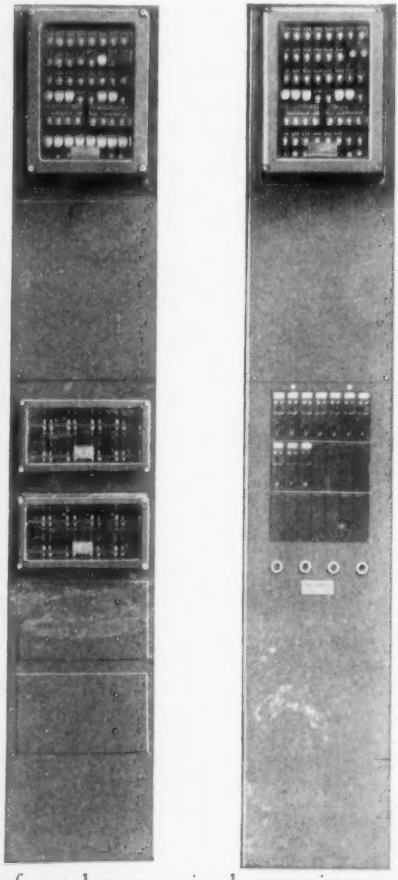
The controlled valves (9 and 11) are placed in the heating and spray lines with by-pass around them. A three-way hand steaming valve (10) is placed in the air line to the spray valve near the controller. This permits steaming at any time independent of the cam schedule.

Two air lines are laid in the kiln with risers (17 and 18) at convenient points. One (17) carries air to the Kilnboy scale, and the other (18) from the Kilnboy scale to the controller and the moisture content gauge. The supply line to the Kilnboy scale is fitted with a reducing valve and an indicating pressure gauge. A capacity tank (8) is placed in the line to the moisture content gauge as an air cushion.

The Kilnboy scale (2) is mounted on the car outside the kiln. When in position in the kiln the flexible air connections (3) are attached to their respective risers and the air turned on. The flexible air connections are fitted with quick detachable couplings marked inlet and outlet.

Improved Simplified Synchronous Visual Supervisory Control

THE Westinghouse Electric & Manufacturing Company have recently introduced an improved and simplified synchronous visual supervisory control equipment which combines simplicity of design with new high speed performance and old reliability.



This system is a complete supervisory control which provides for any number of remote metering and synchronizing indications as well as any number of remote control operations and supervision indications—all over the same four line wires. Synchronous Visual systems have been in successful operation for five years and the new equipment is but a simplification of time tried, proven design.

Only telephone relays are used. The improved equipment, like the first, pioneer supervisory control system placed in successful operation in 1921, is an all-relay system employing the same type of relays used on the first equipment. The proven reliability and extreme simplicity of the relays reduces maintenance to a minimum, there being no complicated mechanical parts requiring specialized service, frequent adjustment or replacement.

As has always been a feature of synchronous visual supervisory control, any number of apparatus units in systems of any size may be placed under the control of a single dispatcher. The apparatus is normally at rest and is started either by the dispatcher or when an automatic operation takes place in the substation being controlled.

The design is positively arranged so that there is no possibility of a false operation due to any disturbance on the supervisory line wires such

as might be caused by lightning or by induction and surges from nearby high tension line. The equipment is mounted on modern steel panels giving a very compact and readily accessible assembly.

New Precision Scales

(Exact Weight Scale Company)

IN these scales, built for commercial usage, are displayed the qualities which make them semi-analytical balances on which the act of weighing is a visible operation.

Weighing perfectly out-of-level, they example utmost simplicity in mechanical structure which requires no adjustment to a new position.

These scales are designed in metric and avoirdupois to suit varied requirements. In the 100-gram capacity these scales are capable of 50 milligram visible sensitivity. Grain sensitivity is likewise accomplished in the capacity of 1500 grains.

The model No. 51 shown in the illustration has a metric capacity of 100 grams. The beam capacity is 2½ grams graduated by 50 milligrams, with loose weights to maximum capacity. Sliding friction poise, general structure, all-aluminum polished with nickel trimmings. Two inch diameter weight platter; three inch diameter merchandise platter. Agate bearings. Height 15¾", length 13", width 5⅜". Elevation of platters 5½".

Avoirdupois capacity, 4 ounces. Beam capacity, 1/10-oz. graduated by 1/500-oz., with loose weights to maximum capacity.

These scales are adapted to analytical selective processes, to jewelry manufacture, to laboratory research, to experimental dietetics, to textile production, to color determination in dye formulae, etc.

The Vibroscope
A portable stroboscope for observing mechanisms in motion.

The Davey Dynamic Balancing Equipment
A portable instrument for balancing all types of rotating parts while running under their own power.

The Davey Vibrometer
A sensitive instrument for the measurement of vibrations.

ELECTROCON CORPORATION - - - - 6 Varick St., New York

New Radio Continuity Tester

(Roller Smith Company)

THE Type HTD Circuit Tester was placed on the market about two years ago. This Circuit Tester met with instant favor and large numbers of them were sold for general testing purposes.

It has been found, however, that the Circuit Tester possessed certain limitations when used for some radio applications. The new Radio Continuity Tester was designed, and is now offered, as an ideal instrument for making a wide variety of tests on radio receiving sets, in particular, and on many other radio devices and circuits. The Continuity Tester will, without any other instruments, perform the majority of the essential tests on its many types of radio sets.

The Continuity Tester scale is graduated in 50 uniform divisions. The range covered is from zero to 100,000 ohms. Indicative readings can be obtained instantly on rheostats, fixed resistances, condensers, by-passes and primaries and secondaries of both audio and radio frequency transformers. Shorts and open circuits can be detected instantly.

The standard flash light battery is self-contained. It has very long life and may be quickly replaced with a new one when necessary.

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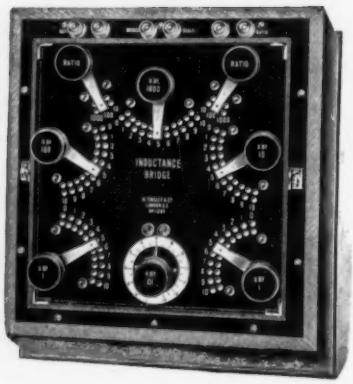
Non-Inductive Bridge

(H. Tinsley & Co.)

THIS bridge has been designed for use in the measurement and comparison of Inductances and Condensers to a high degree of accuracy.

In order to minimize capacity and inductance errors in the bridge itself, special care has been taken to make the bridge occupy as small volume as possible, and to make the internal connections as short and symetrical as is practically convenient.



This bridge consists briefly of two sets of Ratio Coils, each containing three coils of 10, 100 and 1,000 ohms, and five decade dials, each containing ten coils of 1,000, 100, 10, 1 and 0.1 ohms. To further subdivide the 0.1 ohm section a small circular slide wire is added, which can be read to 1/100th part of the 0.1 ohm stud, thus making the lowest range on the bridge, when equal ratios are used, 0.001 ohm. The enormous range of this bridge is at once apparent, and the great sensitivity obtained by keeping the ratios level, is not sacrificed by stepping down or up.

The feature of the bridge is the double stud system of contacts, which keeps the internal leads of the connecting stud of the coil, as each coil is switched in, of low constant inductance for all positions of the switch, but at the same time minimize the value by keeping the loops as small as possible.

The mechanical construction of the instrument is of the best quality, and the studs are made as small as possible in order to keep down metal, and each one is capped with silver-gold alloy to prevent corrosion and to reduce resistance. The brushes connecting the two studs are extremely short, and made of a large number of solid silver-gold leaves. These brushes are mounted on nickel-silver frames in order to reduce possible eddy currents, the nickel silver frames not forming any part of the connecting circuit.

All the contacts are enclosed by a plate glass cover which can be easily removed by undoing two nuts and lifting off the handle of the separate switches.

Three pairs of terminals are provided, one pair for each ratio and the other for the resistance work of the instrument.

Special attention has been given to the windings of the coils, these being wound on glass bobbins, and the windings stranded and wound bifilar in order to reduce their time constant.

In addition to this bridge being of great use for Inductance and Capacity measurements, it is also a very high grade Wheatstone Bridge for general purposes.

The resistance of the internal connections of the bridge is of the order of .01, and this actual value is given at the time of sending out the bridge, as in some cases it is necessary to take it into account. This is done at once by turning round the zero of the last dial. It is impossible to make it absolutely zero, and it is therefore stated.

Catalogue Library

Check any of the publications you want. Remove the page and send with coupon to INSTRUMENTS. They will be forwarded to you without cost or obligation.

AUTOMATIC FLOW CONTROL FOR WATER USING INDUSTRIES. A leaflet describing a flow control for water going into mixers. Baker Perkins Co., Saginaw, Mich.

AUTOMATIC MOISTURE CONTROL. Bulletin describes the moisture Verigraph, a precision instrument for automatic control of moisture content. Atlantic Precision Instrument Company, 61 Sherman St., Malden, Mass.

ARCO METAL PIPE. This bulletin gives information on this new ni-chrome alloy iron, cast by a process which gives the resultant product greater ductility and tensile strength, and also, due to the close grain structure, greater corrosion and erosion-resisting qualities than ordinary gray cast iron. Form No. 9012. American Radiator Company, 40 West 40th St., New York, N. Y.

BAKELITE REVIEW. A new periodical of Bakelite achievements. The April 1929 issue is Vol. 1, No. 1. Bakelite Corporation, 247 Park Ave., New York, N. Y.

CLIMB INDICATOR. This leaflet covers the Climb Indicator. Pioneer Instrument Company, 754 Lexington Ave., Brooklyn, N. Y.

DEION CIRCUIT BREAKER. Special Publication 1836 consists of a series of A.I.E.E. papers together with Electrical World and Electric Journal articles. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

DEVICES FOR THE CONTROL OF COMPRESSED GASES. Bulletin on Ammonia valves, Valvo-gages, Reducing valves, Micrometric controls, Needle valves and Flo-gages. Hoke, Inc., 22 Albany St., New York, N. Y.

D. C. GALVANOMETERS AND MICROAMMETERS. Leaflet covers Model 375 and 440 galvanometers and Model 440 microammeters. Weston Electrical Instrument Corp., Newark, N. J.

DIRECT READING COMPARATOR. A new direct reading comparator is described in a leaflet. Federal Products Corp., Providence, R. I.

DYNAMIC BALANCING SIMPLIFIED is the title of a bulletin describing the Gisholt dynamic balancing machine. Gisholt Machine Company, Madison, Wis.

ECONOMY THROUGH CALORIMETRY. Bulletin describes the recording gas calorimeter. Burgess-Parr Co., Moline, Ill.

ELECTRICAL INSTRUMENTS. Folder contains leaflets on Resistance Boxes, Wheatstone Bridges, Magnetometers, Resistances, and Kelvin Bridge. Rubicon Company, 29 North Sixth St., Philadelphia, Pa.

ELVERSON OSCILLOSKOP. Bulletin describes an instrument for studying machines in motion. The instrument is essentially a stroboscope. Bulletin is printed in German. Klaus-Friedrich Hahn & Co., Berlin W35, Lützowstrásse 84b, Germany.

ESTIMATION OF COLORING MATTER IN TANNING SOLUTIONS. Reprint of an abstract for an article in the Journal of the International Society of Leather Trade Chemists. Tintometer, Ltd., 1 The Friary, Salisbury, England.

FOLDING SLING PSYCHROMETER. Leaflet briefly describes the Parko Folding Sling Psychrometer. Parks-Cramer Company, Fitchburg, Mass.

GENERAL CATALOGUE. Folder contains literature on CO_2 meters, Flue gas pyrometers, Draft gauges, Portable Differential Gages, Pointer Type Draft gages, Mercury Column Pressure Gages, Mecurial Barometers, Recording pressure and vacuum gages, Seven day clocks, Thermometers, Orsats. Defender Automatic Regulator Company, St. Louis, Mo.

GAS SERVICE JOURNAL. The April issue contains the following: Economics of High Pressure Transportation for Natural Gas Pipe Lines; Sand Drying Makes Trolley Brakes Safe. The May issue contains articles entitled: Pressure Regulation in Denver; Heat, Humidity and Air Motion and Their Effect On Our Comfort; Developments in Gas Refrigeration; Carbon Black. Pittsburgh Equitable Meter Co., 400 Lexington Ave., Pittsburgh, Pa.

GENERAL CATALOGUE. Bulletin No. 96-2 briefly describes the different types of indicating, recording and controlling instruments of the Foxboro Company, Foxboro, Mass.

HIGH FREQUENCY STABILIZATION. The method of application and particulars of the Hilger Oscillators are described in this bulletin. Adam Hilger, Ltd., 24 Rochester Place, Camden Road, London, M.W.1, England.

ILLIUM. This leaflet presents information on a metal that resists the attack of acids. Burgess-Parr Co., Moline, Ill.

INSTRUMENT INVESTMENT NEWS. The April 1929 issue contains articles entitled: Accurate Temperature Regulation Pays; The Power Control Valve Controls Boiler Operation; All Important Temperatures and Pressures Available at One Point. Consolidated Ashcroft Hancock Company, Inc., 100 East 42nd St., New York, N. Y.

JEWEL TORCHES. This leaflet covers a small torch for working glass, soldering, brazing, lead burning, etc. Hoke Inc., 22 Albany St., New York, N. Y.

LIQUID LEVEL CONTROLLER. Bulletin No. 241 covers the principle and operation of the liquid level controller. Builders Iron Foundry, Providence, R. I.

MERCOID CONTROLS. Catalog No. H5 describes complete automatic controls for domestic and industrial heating equipment. The Mercoid Corporation, 564 West Adams St., Chicago, Ill.

METERED COMBUSTION CONTROL. Feature No. 8 illustrates metered combustion control on central station burning pulverized fuel (bin system). Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

MICRO BALANCES. Leaflet gives specifications and prices of Micro Balance No. 300. Christian Becker, Inc., 92 Reade St., New York, N. Y.

MOISTURE METER. Bulletin 978 presents the New Tag-Heppenstall Moisture Meter. C. J. Tagliabue Mfg. Co., 18 Thirty-third St., Brooklyn, N. Y.

MONOCHROMATOR. English leaflet illustrates Van Cittert's Double Monochromator. Kipp & Zonen, Delft, Holland.

OIL CIRCUIT BREAKERS. Circular No. C-1824 gives a description of the application, distinctive features and operation of these circuit breakers. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

POWER CONTROL VALVE. Bulletin No. 1525 outlines the function and describes the Power Control Valve. Consolidated Ashcroft Hancock Co., Inc., 100 E. 42nd St., New York, N. Y.

POWER FACTOR CORRECTION. The use of graphic instruments by power producers and power users in the elimination of the evils of low power factor is taken up. Bulletin 329. Esterline-Angus Co., Inc., Indianapolis, Ind.

RADIO CONTINUITY TESTER. The Type HTD radio continuity tester is covered in Supplement No. 1 to Bulletin No. 300. Roller-Smith Co., 233 Broadway, New York, N. Y.

RESTORING PROFITS BY DEGREES. Direct Mail Piece describes control of gas fired japan oven. Bristol Company, Waterbury, Conn.

RESONANT CONTROL OF STREET LIGHTS. Publication No. C1757-B covers recently perfected method of control for street lighting systems. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

ROCKWELL DILATOMETER. Bulletin No. 2904 briefly discusses the application of the dilatometer. Stanley P. Rockwell Company, 66 Trumbull St., Hartford, Conn.

SAVING $9,000 A YEAR. This is the title of Leaflet F-10-P25,127. It points out the advantages of the L & N Automatic Hot-Blast Recording Controller. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

SEISMOGRAPHS. Bulletin, dated 1929, gives a description of the galvanometric method of registration. It also describes the aperiodical horizontal pendulum; the aperiodical vertical seismograph with temperature compensation; the Hartmann & Braun moving coil galvanometer and the recording apparatus and accessories. H. Masing Werkstatt fuer Praezisionsmechanik, Estland, Tartu-Dorpat.

SPECTROSCOPY IN CONTROL OF PURITY IN FOOD STUFFS. Bulletin considers the subject in four divisions: (1) Emission spectrography as applied to the examination of inorganic materials; (2) Emission spectrography as applied to the examination of organic materials; (3) Absorption spectra of organic materials in the visible region and (4) Absorption spectra of organic materials in the ultra-violet region. Adam Hilger, Ltd., 24 Rochester Place, Camden Road, London, N.W.1, England.

STATIC BALANCER. Leaflet described the improved static balancer for balancing flywheels, clutches, road-wheels, automatic parts, etc. Gisholt Machine Company, Madison, Wis.

STEPHENS IMPROVED MECHANICAL CONSISTOMETER. Leaflet describes this instrument for checking the working properties of any kind of lubricant, hot or cold, duplicating the internal combustion engine and transmission and car journals, as near as possible, recording results. Consistometer Laboratories & Mfg. Co., 332 South Michigan Ave., Chicago, Ill.

STOP WATCHES. Price List No. 508 gives the prices of plain and split second stop watches. Herman H. Sticht & Co., 21 Park Row, New York, N. Y.

SURFACE TENSION BALANCES. Bulletin No. 311 briefly describes the surface tension "Chainomatic" balance No. 150. Christian Becker, Inc., 92 Reade St., New York, N. Y.

TEMPERATURE CONTROL IN THE TANNERY. The value and practicability of temperature control in the tannery is discussed in Bulletin T-107. The Fulton Company, Knoxville, Tenn.

TEMPERATURE REGULATORS. Bulletin T-110 describes temperature regulators for automatically and accurately regulating temperature of liquids and air for various purposes. The Fulton Co., Knoxville, Tenn.

TEMPERATURE REGULATION. Bulletin considers heat regulation for heating purposes pointing out the waste due to overheat, and open window waste. The advantages of temperature regulation are given. Powers Regulator Company, Chicago, Ill.

TESTING METERS AND FLOW IN GAS WELLS. Leaflet describes application of the manometer to testing the accuracy of recording meters and the open flow of gas wells, also the continuous testing of recording meters with an indicating flow meter. Meriam Co., Cleveland, Ohio.

TESTING MACHINES. Folder contains bulletins on the following: Testers for yarn, twine, cloth, raw silk, fabrics. Also yarn scales and measuring reels, twist counters, ball burst test apparatus. Henry L. Scott Co., Providence, R. I.

TESTING MACHINES. Folder contains bulletins on universal testing machines, Brinell machines, workability testing machines, fatigue testing machines, spring testing machines. Losenhausenwerk, Dusseldorf-Grafenberg, Germany.

TEXTILE TESTING MACHINERY. Folder contains leaflets on twist counters, inspection reflectors, conditioning ovens, inspection card winders, gage machines, cohesion machines. United States Testing Co., Inc., 316 Hudson St., New York, N. Y.

(Continued on page 26)

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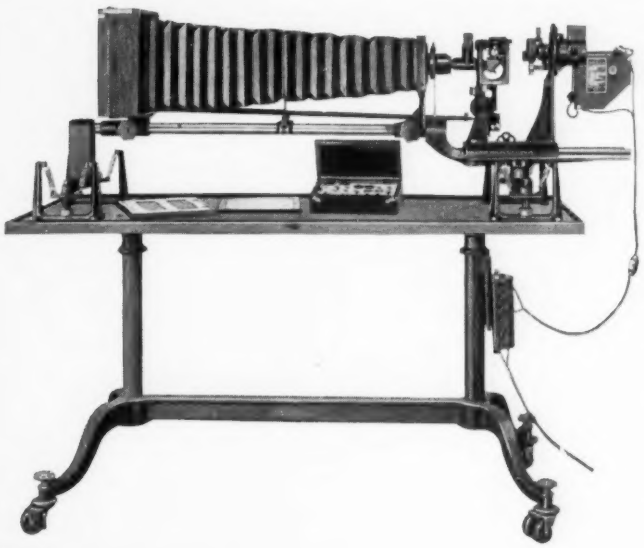

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Current Literature Review

Abstracts on instruments and devices for measurement, inspection and control

The Technology Department, Carnegie Library, Pittsburgh, Pa., will furnish photostats of material abstracted here. Negative prints are 35 cents per page, plus 10 cents for mailing (first class). All orders should be paid in advance. The library is not responsible for loss in mails.

Determination of the Reflecting Power of Metals and Reflectors for Ultra-Violet Light by Means of a Cadmium Cell and Electrometer. A. Ruettenauer. Licht und Lampe, Aug. 23, 1928, pp. 595-596.

The methods of Pfestori, and Hagen and Rubens of measuring ultra-violet reflecting powers of metals are briefly mentioned and the present method, involving a cadmium cell and electrometer described. A few values are given. The author suggests that elements of the same periodic class have similar reflecting power properties.—Abs. Bull. Kodak Res. Labs.

Recent Pressure Gauge Development. Report of the Oxy-Acetylene Committee, International Acetylene Association, Nov. 1928, pp. 12-13.

The standardization of gauges is briefly discussed.

Procedure Control. Report of the Oxy-Acetylene Committee, International Acetylene Association, Nov. 1928, pp. 18-21.

This report is a brief review of the progress and some applications of procedure control.

Long Duration Tensile Tests on Metals at High Temperatures. Brown Boveri Review. Nov. 1928, pp. 315-320.

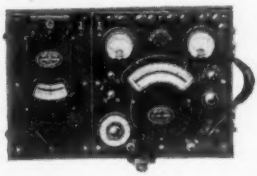
A review of earlier tests is given. The Brown Boveri apparatus for making the long duration tests is described and the method of conducting the tests and results are given.

Action of Accelerators and Inhibitors upon the Oxidation of Liquid Hydrocarbons. T. E. Layng and M. A. Youker. Ind. Engg. Chem., Oct. 1928, pp. 1048-1052.

Apparatus has been devised and a method described for determining the effect of various inhibitors and accelerators of knock upon the slow oxidation of hydrocarbon fuels.—M.E.H.

Relative Rates of Reaction of Olefins in Combustion with Oxygen and in Oxidation with Aqueous Potassium Permanganate. Harold S. Davis. Ind. Engg. Chem., Oct. 1928, pp. 1055-1057.

Apparatus for competitive oxidations of olefins by permanganate in aqueous solution is diagrammed.—M.E.H.



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Measure Temperature of Molten Cast Iron. H. T. Wensel and W. Roeser. Foundry, March 15, 1929, pp. 245-248.

Abstract of paper presented at the Philadelphia convention of the American Foundrymen's Association. This is the second and concluding article on the measurement of molten cast iron temperatures. Results obtained in measuring temperatures of seven different types of cast iron are given. The necessary corrections to give readings when using optical type pyrometers are given.

A New Type of Precision Frequency Changer for Instrument Calibration. E. Greibach. Elect. Jl., March 1929, pp. 125-126.

The frequency changer is briefly described.

Design and Practical Test of Integrating Flume Meter. J. W. Ledoux. Engg. News Rec., March 14, 1929, pp. 428-430.

Elements of design developed by formula. Meter and register built and then tested in field against a weir.

Physical Tests of Vitreous Enamels. C. J. Kinzie. Jl. Amer. Ceram. Soc., March 1929, pp. 188-192.

Methods and apparatus for determining certain physical properties of vitreous enamels are described. These properties are as follows: (1) resistance to thermal shock of vitreous enamels applied to flat surfaces, (2) resistance to mechanical impact of vitreous enamels, (3) resistance of vitreous enamels to abrasion.

Lightning Surges Measured. A. M. Opsahl. El. World, March 16, 1929, pp. 535-539.

This article describes the five mile transmission line used to measure the effects of surges from lightning generator. It further discusses the effects of choke coils and arresters. Experiments check theory.

Study of Noises in Electrical Apparatus. T. Spooner and J. Foltz. Jl. A.I.E.E., March 1929, pp. 199-202.

The objections to unnecessary noises in electrical apparatus are becoming so insistent that the manufacturers are making every effort to reduce them. In order to attack the problem intelligently it is first necessary to determine the amplitude and frequency of the components of the complex sounds. The first requirement then is a simple portable sound analyzer. Descriptions are given of the resonance types which have been developed. There is included also a short discussion of the laws of sound variation and sound units. Finally there are discussed various applications of the sound analyzer to the study of noises in gears, motors, generators, induction regulators, loud speakers, vacuum sweepers, and the like.

Insulation Tests of Electrical Machinery. C. Gelt and B. Borns. Jl. A.I.E.E., March 1929, pp. 228-232.

Many purchasers test equipment after installation before placing it in service to be sure that the connections and equipment are in a safe condition for service. It is recommended that a standard test voltage be established that may be used under such conditions.

It also seems to be advisable that suitable rules should be set up governing test voltages that should be used in a maintenance program. Periodic observations of the insulation resistance are suggested as substitute or supplemental tests.

The International Temperature Scale. Research Paper No. 32, U. S. Bureau of Standards.

This paper presents the agreement entered into by the Bureau of Standards, National Physical Laboratory on the Physikalisch Reichsanstalt. It affords a satisfactory basis on which uniformity in certification of temperature measurements for industrial purposes may be maintained.

Telemetering. C. Linder, C. Stewart, H. Rex and A. FitzGerald. Jl. A.I.E.E., March 1929, pp. 183-185.

This paper surveys the field of application of telemetering presenting types of telemeters available. Operating requirements and channels available for the transmission of readings are discussed and an installation of the varying frequency type telemeter on the Montaup Electric Company's System is described.

Electrical Aids to Navigation. R. Marriott. Jl. A.I.E.E., March 1929, pp. 195-199.

This paper outlines electric and magnetic aids to navigation by water and air. The principal subjects discussed are the earth inductor compass, the radio compass, the radio beacon, submarine signals, depth finders, distance finders, channel marking signals, fog-penetrating lights, height indicators for aircraft, etc.

Lenses. C. Beck. Jl. Sci Insts., Feb. 1929, pp. 40-49.

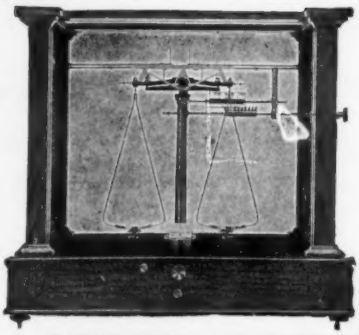
A paper given at the Nineteenth Annual Exhibition of the Physical and Optical Societies. The paper considers various kinds of lenses and the images obtained.

The Application of Spectographs in the Metal Industry. (Anwendungen des Spektrographen in der Metallindustrie.) F. Twyman, E. Honegger and D. Smith. Zs. V.D.I., Feb. 9, 1929, pp. 196-200.

This article points out the advantages of the spectrographic methods of analysis, especially when using ultra-violet rays. The article also describes the present day spectrographs and spectroscopes. The method is more suitable for non-ferrous than for ferrous materials, as iron has a very complicated spectrum. With the use of the photometric method, spectro-analysis can also be applied to ferrous alloys.

Methods for Increasing the Efficiency of Interference-spectroscopes. (Methoden zur Steigerung der Leistungsfaehigkeit von Interferenzspektroskopen.) E. Lau, Zs. Instrumenk, Feb. 1929, pp. 57-63.

The Perot-Fabry-Etalon and Lummer Gehrcke Plate are considered.



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Photographic Objectives. (Photographische Objektive.) R. Thun. Zs. V.D.I., Jan. 12, 1929, pp. 49-52.

Various lens arrangements are considered.

Longitudinal Forces in Rails. (Laengskraefte im Eisenbahngleis.) Dr. Ammann and Dr. Gruenewaldt. Zs. V.D.I., Feb. 2, 1929, pp. 157-161.

The stresses in rails due to temperature changes are determined. The movement of the rails in relation to the ties is studied. The resistivity of a rail to longitudinal and sideward displacement is studied on a special test stand.

Test Measurements with the Bosshardt-Zeiss Self Reducing Stadia Transit. (Versuchsmessungen mit dem selbstreduzierenden Destanzmesser.) F. Ackel. Zs. Instrumentenk, Feb. 1929, pp. 64-71.

The results of a test made at the Hochschule fuer Bodenkultur are described.

Testing of the New Zeiss Leveling Instrument. (Pruefung des neuen Zeiss-Nivellierinstruments II.) O. Gruber. Zs. Instrumentenk, Feb. 1929, pp. 71-79.

The results of a test made at the Technische Hochschule Stuttgart are given.

Calorimeter: Heat Capacities in Aqueous Salt Solutions. Merle Randall and Frederick D. Rossini, Jl. Amer. Chem. Soc., 51, Feb., 1929, pp. 323-345.

The assembly of a calorimeter having a precision of greater than 0.1 per mille in measuring differentially the heat capacities of aqueous solutions is described, and a description of its calibration and method of operation for direct and for differential heat capacity measurements is given.—M. E. H.

Gravimetric Method for Micro Determination of Molybdenum. Joseph B. Niederl and Edith P. Silbert, Jl. Amer. Chem. Soc., Feb., 1929, pp. 376-377.

A rapid gravimetric micro method for the quantitative determination of molybdenum in organic compounds is described.—M. E. H.

Oxidation-Reduction Potentials. I. The Ferric-Ferrous Electrode. Stephen Popoff and Adolf H. Kunz., Jl. Amer. Chem. Soc., Feb. 1929, pp. 382-394.

A method is devised for the precise determination of oxidation-reduction potentials, consisting of the use of a special electrode vessel, suitable procedure, and mathematical and graphical treatment which eliminate uncertainties in former methods regarding liquid junction potentials and the activity of one electrolyte in the presence of others.—M. E. H.

A Micro Extraction Method. Joseph B. Niederl, Jl. Amer. Chem. Soc., (Note) Feb. 29, p. 474.

For extracting very small amounts of material.—M. E. H.

A Simple Reference Electrode for Potentiometer Titrations. H. H. Willard and A. W. Boldyreff, Jl. Amer. Chem. Soc., Feb. 1929, pp. 471-474.

A simple reference electrode has been devised, consisting of a platinum wire fused into the tip of the buret.—M. E. H.

Auto-Ignition Temperatures of Flammable Liquids. Norman J. Thompson, Ind. Engg. Chem., Feb. 1929, pp. 134-139.

Apparatus for determination of auto-ignition temperatures is described.—M. E. H.

Low-Temperature Carbonization of Coal. S. W. Parr, Ind. Engg. Chem., Feb. 1929, pp. 164-168.

Apparatus for determination of ignition temperature of coal and coke are included and diagrams given.—M. E. H.

Quantitative Analysis with the Spectrograph. Charles C. Nitchie, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 1-7.

The superiority of spectrographic methods for the estimation of small amounts of impurities and minor constituents in materials is pointed out.—M. E. H.

Simple Pressure Regulator for Vacuum Distillations. Henry L. Cox, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 7-8.

The apparatus, entirely automatic, consists of a motor-driven pump and a relay, a closed-arm mercury manometer and contact to the relay thru a battery. Pressure can be maintained constant to within 0.1 mm.—M. E. H.

Automatic Apparatus for the Determination of Small Concentrations of Sulfur Dioxide in Air-II. Moyer D. Thomas and John N. Abersold, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 14-15.

The method is claimed to be fully as reliable as the iodine method in the absence of SO_3 and permits the construction of apparatus which is completely automatic.—M. E. H.

German Apparatus Determines Ignition Point of Coke. Iron Age, March 7, 1929, p. 674.

By imparting internal heat to the ground sample of coke by a hot current of air, the ignition temperature can be measured and recorded.—Ha.

On Metallic Contact Resistance. (Ueber metallische Kontaktwiederstaende). R. Holm, Wiss. Ver. Siemens Konz., Vol. VII, 1929, pp. 217-271.

This article gives in considerable detail the results of investigations on contact resistance.

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MESSEN UND WAEGEN. *Walter Block*, with introduction by Fritz Plato. Otto Spamer, Leipzig, 1928. 339 pages, 109 figs. Price $8.00 postpaid.

REVIEWED BY RICHARD RIMBACH

In the introduction Plato describes the development of the measuring science and of weights and measures, which led to the German regulations for weights and measures based on international agreement.

This is followed by a general discussion of measurements and measuring systems, the measurement of time, angles, lengths and areas are considered. Considerable space is given over to the determination of volume, weight and measurement of density, as this is especially important for the chemist.

In the chapter on temperature measurement, the instruments for the determination of temperature are described: gas, mercury, resistance thermometer, thermocouples and radiation pyrometers. Block emphasizes that special care should be given to the installation of measuring devices, particularly if they are to be used for measuring gas temperatures.

A bibliography of measuring methods is provided.

EMPFINDLICHE GALVANOMETER FUER GLEICH UND WECHSELTROM. *Dr. Otto Werner.* Walter de Gruyter & Co., Germany, 1928. 208 pages, 93 figs., 17 tables.

REVIEWED BY M. HARTENHEIM

This book treats of the instruments, measuring methods and accessories. It is an aid in the selection of the proper instrument for a certain measurement.

NEW AND REVISED TAG MANUAL FOR INSPECTORS OF PETROLEUM. *Edited by R. M. Wilhelm.* C. J. Tagliabue Mfg. Co., New York, N. Y., 1927. 120 pages, $2.00 postpaid.

REVIEWED BY RICHARD RIMBACH

This new edition is thoroughly revised and additional tables, data and testing methods have been included. Among the new tables are Table I—Revised Gravity Temperature Correction Table for A.P.I. Hydrometers; Table II—Pounds per Gallon Table. The test for the color of lubricating oils by means of the Union Colorimeter has also been added.

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Characteristics of Contact Resistances. (Charakteristiken von Kontaktwiderstaenden). E. & R. Holm, Wiss. Ver. Siemens Konz., Vol. VII, 1929, pp. 272-304.

The characteristics of contact resistance are given. This work on the subject was carried out at the same time as that reported in "On Metallic Contact Resistance."

New Photographic and Evaluating Equipment for topographic problems. R. Hugershoff. Bildmessung und Luftbildwesen. March, 1929, pp. 24-29.

The equipment is illustrated and described.

New Equipment and Methods for the photogrammetric closing of unexplored territory. C. Aschenbrenner, Bildmessung und Luftbildwesen, March, 1929, pp. 30-38.

A paper read before the Deutshen Gesellschaft fuer Photogrammetrie.

Synchronous Selector Control and Telemetering. C. E. Stewart, Nat. Engr., April, 1929, pp. 151-152.

Abstract of a paper delivered at the Midwest Power Conference. The equipment is described.

Endurance Flights. H. B. Henrichson, Aero Digest, April, 1929, pp. 38-39, 266.

The checking of time by means of the barograph is described.

Multiple Watt-hour Meters. W. Bergmann, AEG Mitteilungen., March, 1929, pp. 150-154.

The meters are illustrated and described. These meters are for use where different rates ar applied at different times.

Measurement of Effective Wave Lengths. W. Duane, J. C. Hudson & H. Sterling, Amer. Jl. Roent, Sept. 1928, pp. 241-245.

Effective wave-length of a band of X-ray wave-lengths is defined, in general, as the wave-length of monochromatic radiation which would produce the same effect (instrumental) that the actual radiation produces. Curves are given for the relation between transmission value and effective wave-length and typical values of effective wave-length are given for several combinations of tube voltage and X-ray filter.—Kodak Res. Lab. Abs. Bull.

Magnetic Investigations of Carbon Steel. Clifford C. Duell, Trans., A.S.S.T., April 1929, pp. 630-651.

This paper reports the results obtained by magnetic methods in an investigation of irons and steels of various carbon contents and in various conditions.—M. B. R.

Textiles as Insulators. A. C. Walker, Bell Labs. Rec., April, 1929, pp. 305-310.

This article shows the relation between insulation resistance and humidity of various materials.

The Electromagnetic Oscillograph in the Circuit Laboratory. L. J. Stacy, Bell Labs. Rec., April, 1929, pp. 327-330.

Some interesting applications are discussed.

Aerophotography in the Service of the Swiss Geodetic Survey. K. Schneider, Bildmessung und Luftbildwesen, March, 1929, pp. 1-24.

A paper read before the Deutschen Gesellschaft fuer Photogrammetrie.

Note on an application of the Whiddington Ultra-Micrometer. H. Lloyd, Jl. Sci. Insts., March, 1929, pp. 81-84.

Methods are given which have been employed for overcoming some difficultics met with in using a hetrodyne micrometer, and improved arrangements are described for the indication of the zero-heat condition audibly or visibly.—M. B. R.

A Method for the Measurement of the Joule Magnetostrictive Effect in a cold drawn wire. J. H. Handley, Jl. Sci. Insts., March, 1929, pp. 84-88.

The paper gives the modifications which were made to render the ultramicrometric device of Whiddington applicable to the measurement of the Joule Magnetostrictive effect in a wire which has been subjected to a large amount of cold work.—M. B. R.

Measurement of Light Absorption. H. von Halban & J. Eisenbrand, Zs. wiss. Phot., Feb., 1928, pp. 138-152.

Critical survey of the photographic and photo-electric methods for determination of light absorption. The conclusion is reached that "by employing a sufficiently large extinction the photographic method permits the extinction coefficient to be determined to within a small percentage error." The photographic methodis not suitable for small differences between extinctions, the photo-electric method giving, under favorable conditions, a sensitivity to differences of extinction about 10^2 beyond that of the photographic. The various photo-electric cells show unexpectedly large variations, which need explanation, in the dependence of sensitivity on wave-length. Exact knowledge of the properties of the cells employed is especially of importance when measurements have been carried out with not quite pure light.—Kodak Res. Lab. Abs. Bull.

Precision Refractometer. Jl. Frank. Inst., Jan., 1929, pp. 116-119.

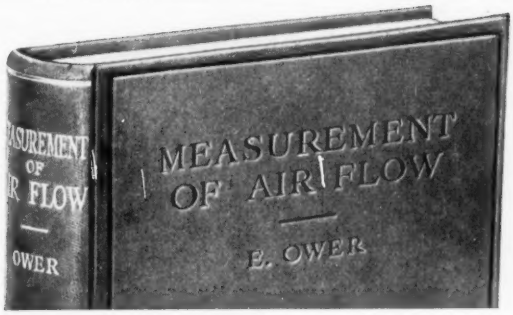
Description of the precision refractometer invented by W. P. Valentine. It is the result of many improvements upon the Abbe refractometer, manufactured by Zeiss.—M. B. R.

Rings for Checking Accuracy of Testing Machines. W. S. Morehouse, Iron Age, Apr. 4, 1929, pp. 945.

Article briefly describes the Whittemore-Petrenko proving instrument manufactured by the Morehouse Machine Co.

Aircraft Compass Problems. T. R. Rhea, G. E. Rev, April, 1929, pp. 190-193.

This article takes up compass errors and compass types. The magneto compass and its advantages are taken up.



The Measurement of Air Flow

By

E. Ower, B.Sc. (Lond.), Hons. I., A.C.G.I.

Bramwell Medallist; Member of the Institute of Heating and Ventilating Engineers; Assistant in the Aerodynamics Department, National Physical Laboratory.

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Continuous Laboratory Extractor for Liquids. Alfred W. Francis, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, p. 15.

A simple apparatus of two designs, for light and heavy solvents respectively, is described.—M. E. H.

A New Physical Test for Vulcanized Rubber. D. D. Wright, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 17-20.

This test, by use of a new design of sample, subjects rubber to a combination of tensile and shearing stresses.—M. E. H.

Determination of Small Amounts of Carbon Monoxide in Ethylene. Wright M. Welton with N. L. Drake, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 20-24.

An apparatus and method are described and can be used for determining CO in mixtures containing as little as 5 parts of CO per 100,000 of mixture.—M. E. H.

X-Ray Quantitative Analysis of Tetraethyl Lead in Gasoline. R. H. Aborn and R. H. Brown, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 26-27.

Apparatus is described which has an accuracy of 0.1 cc. of tetraethyl lead per gallon of gasoline.—M. E. H.

Application of the Vacuum Tube in the Falling-Ball Method for Dark-Colored Solutions. E. M. Symmes and E. A. Lantz, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 35-36.

A simple oscillating circuit is used. The ball falls thru the coils of the circuit and produces a change in the frequency and in the note observed. The time elapsed between the change in hum at the coils is the time required by the ball to pass thru the distance being measured.—M. E. H.

Improved Apparatus for Vapor Pressure Determinations. O. A. Pickett, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 36-38.

Ramsay and Young's apparatus has been modified considerably. Diagrams are given and the method described.—M. E. H.

Simple Apparatus for Measuring Vapor Pressure of Volatile Liquids. Alfred W. Francis, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 38-39.

An apparatus is described which measures the vapor pressure in a Toricelli vacuum.—M. E. H.

Rapid Determination of Specific Gravity of Semi-Solid Bituminous Substances. S. E. Berkenblit, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 39-40.

A method is described which requires no cleaning of pycnometer and only one weighing, and can be used with all kinds of solid and semi-solid materials.—M. E. H.

Manometer for Determination of Gases in Vapors. D. F. Othmer, Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, p. 46.

This instrument combines the characteristics of a gas thermometer with those of a vapor-pressure thermometer.—M. E. H.

A Standard Method for Determining the Viscosity of Cellulose in Cuprammonium Hydroxide. Committee: Div. of Cellulose Chem., Ind. Engg. Chem., Analytical Ed., Jan. 15, 1929, pp. 49-51.

The method is a composite of the various methods used. Diagrams of the apparatus are given.—M. E. H.

Calorimeter: The Heats of Dilution of Sodium Hydroxide, etc. Theodore W. Richards and Frank T. Gucker, Jr., Jl. Amer. Chem. Soc., March, 1929, pp. 712-736.

Detailed diagram and description are given of the calorimeter and its accessories.—M. E. H.

Vapor Pressure and Vapor Density Apparatus: The Vapor Pressure and Vapor Density of Intensively Dried Ammonium Chloride. Worth H. Rodebush and John C. Michalek, Jl. Amer. Chem. Soc., March, 1929, pp. 748-759.

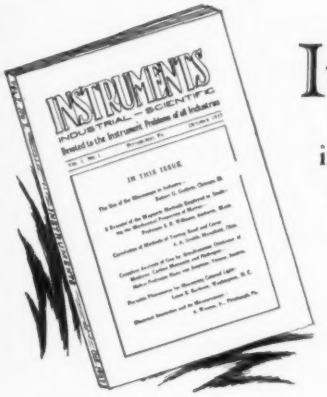
The apparatus for measuring the vapor pressures of substances like ammonium chloride is the glass diaphragm manometer according to Farrington Daniels. Vapor density was measured by means of a quartz microbalance after the design of Stock.—M. E. H.

Sonic Interferometer: Some Studies of the Physical Properties of Liquids. The Velocity of Sound in Some Organic Liquids and their Compressibilities. Egbert B. Freyer with J. C. Hubbard and Donald H. Andrews, Jl. Amer. Chem. Soc., March, 1929, pp. 759-770.

The method of Hubbard and Loomis for measuring the velocity of sound in liquids is given. The sonic interferometer for producing and determining the wave length of sound waves is described.—M. E. H.

A Modified Pirani Gage for Use in Corrosive Systems. Gerhard K. Rollefson, Jl. Amer. Chem. Soc., (Note) March, 1929, p. 804.

Instead of a metal wire, a capillary filled with mercury is used as the hot filament.—M. E. H.



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Theoretical and Field Investigations of Lightning. C. L. Fortescue, A. Atherton & J. H. Cox. Jl. A. I.E.E. Apr. 1929 pp. 277-280.

This paper gives a review of some recent developments in the methods of studying lightning phenomena. The Norinder form of cathode ray oscillograph and its application in Tennessee are discussed, together with the information secured.

Bushing-Type Current Transformers for Metering. A Boyajian & W. Skeats. Jl. A. I.E.E. Apr. 1929, pp. 308-312.

This paper describes a new development in connection with bushing type current-transformer metering circuits.

132-Kv. Shielded Potentiometer for Determining the Accuracy of Potential Transformers. C. T. Weller. Jl. A.I.E.E. Apr. 1929, pp. 312-316.

The paper describes a shielded potentiometer for 132 Kv., which is designed for ultimate extension to 220 Kv.

On the Intensity of the K-lines of the Roentgen Spectrum in relation to the Periodic Number. H. Meyer, Wiss Ver. Siemens Konz. Vol. VII 1929 pp. 108-162.

This article considers the origin of the K-lines, and takes up the equipment used in the investigation: the spectrograph, the Roentgen tube and the photometric arrangement. The measuring procedure is given as well as the evaluation of the Spectra.

Monthly Review of the Literature on Surveying Measurements. E. Harbert, E. Brennecke, O. Eggert and O. Gruber, Zs. Vermess, Feb. 15, 1929, pp. 1-17.

Bibliography of articles and books.

The Cathode Ray Oscillograph. K. McEachron, Elect. Light, Apr. 1929, pp. 30-31, 36.

Principle of operation is described.

The Measurement of the Horizontal and Vertical intensity of the earth's Magnetic field with the Magnetron. M. Roessiger, Zs. Instrument, Mar. 1929, pp. 105-116.

The article describes an instrument which uses an electron tube as an indicator for the absolute determination of the vertical and horizontal intensity of the earth's field.

The Surveying and Mapping Activities of the Federal Government. T. W. Norcross, Proc. A.S.C.E., Apr. 1929, pp. 877-897.

The various agencies are discussed with the work carried out.

Oscillographs for Recording Transient Phenomena. W. A. Morrison. Jl. A.I.E.E., Apr. 1929, pp. 261-264.

Two instruments are described for recording very short or very long transients; they may be used in combination. At power frequencies, satisfactory records may be made on films or sensitized paper with a two watt lamp. The instruments and their performance are illustrated by photographs and oscillograms.

Conversion of Hardness Numbers. A. Heller. Amer. Mach., April 4, 1929, pp. 535-539.

This article presents tables for converting from Brinell to Rockwell.

Periodic Inspection of Cylinder Blocks. F. Colvin, Amer. Mach., Apr. 4, 1929, pp. 543-545.

This article gives a method by which many between-operation inspections are eliminated, the accuracy of fixture and tools being checked by periodical inspections of the part.

The Measurement of the Anode Circuit Impedances and Mutual Conductances of Thermionic Valves. L. Hartshorn, Proc. Phys. Soc. Lond., Feb. 15, 1929, pp. 113-125.

The paper describes the application of the Wheatstone Bridge to the measurement of the anode circuit impedance, and the mutual conductance of a valve under actual operating conditions.

A Method for the Determination of the Equivalent Resistance of Air Condensers at High Frequencies. G. Sutton, Proc. Phys. Soc. Lond., Feb. 15, 1929, pp. 126-134.

The losses in air condensers are divided into two portions, (1) those due to leakage through the solid dielectric, and (2) those due to terminal and plate resistance. A method is developed for measuring each, under conditions such that the other is negligibly small. The limits of the errors to which the methods are liable are discussed and some results of practical measurements are quoted.

Portable Demonstration Watt-hour Meter. W. Bergmann, A. E. G. Mitteilungen, March, 1929, pp. 155-157.

This instrument is used to demonstrate the amount of current used by household appliances. It is illustrated and described.

On the Influence of the Crystal Size on the Magnetic properties of Iron. O. von Auwers, Wiss. Ver. Siemens Konz., Vol. VII, 1929, pp. 197-209.

This article covers investigations made on electrolytic iron to determine the relation between crystal size and magnetic properties.

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VERIGRAPH. Bulletin describes an instrument that weighs moving webs of materials without touching them. Atlantic Precision Instrument Company, 61 Sherman St., Malden, Mass.

VOL-U-METER. Bulletin describes a constant-weight filling device for capacities of 5 gallons and upwards. It fills drums, barrels or carboys to any predetermined net weight. The Vol-U-Meter Co., Inc., 710 Ohio St., Buffalo, N. Y.

WATER WORKS JOURNAL. The May issue of this publication contains the following articles: A Century of the Pittsburgh Water Works; The Consumption of Water and the Effects of Metering; Municipal Water Works, Rocky Ford, Colo. Pittsburgh Equitable Meter Company, 400 Lexington Ave., Pittsburgh, Pa.

ZERNIKE THERMOPILE. Gezu 29 describes a new thermopile of 8 elements of improved bismuth alloys. P. J. Kipp & Zonen, Delft, Holland.

MICROSCOPE RECORD. The May 1929 issue of the Microscope Record contains the following articles: Current Microscopy—Photomicrography: The Problem of Exposure; Hints to Beginners; The Scientific Use of the High-Power Microscope in Cytology; Test Objects for Beginners; Eyepiece Micrometers. W. Watson & Sons, Ltd., 313 High Holborn, London, W.C.1, England.

NEW INSTRUMENTS AND APPARATUS. Leaflet covers the following new equipment: Chambers' Microscope Dissecting Apparatus; Watson Thorne Baker Spectrograph; Penfold's Angle Eyepiece; and The "Binar," —A Combined Waistcoat Pocket Telescope and Magnifier. W. Watson & Sons, Ltd., 313, High Holborn, London, W.C.1, England.

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Shaft Behavior at Critical Speed. H. D. Taylor, G. E. Rev, April, 1929, pp. 194-200.

A stroboscopic apparatus for measuring the angle of lag is described.

Acoustic Considerations Involved in Steady State Loud Speaker Measurements. L. G. Bostwick, Bell Jl., Jan., 1929, pp. 135-158.

Certain difficulties encountered in acoustic measurements of the performance of loud speakers are described. Because of the nature of these difficulties it has not yet been possible to specify a complete and simple set of measurements or conditions which will completely express the performance of a loud speaker. Data are given showing the performance of two representative types of loud speakers both when measured in outdoor space free from reflections and when measured under varying conditions in a specially treated acoustic laboratory.

The Use of Interfacial Tension Measurements in the Examination of Insulating Oils. Jl. Sci. Insts., March, 1929, pp. 90-95.

This paper describes a method which has been developed at the laboratories of the International Standard Electric Corp.for the determination of the interfacial tension at an oil-acid interface. The device is semi-automatic in operation, does not involve any expensive apparatus and is well suited to semi-routine tests, such as would be made during the examination of various insulating oils. It is of special value in the examination of dark oils, to which the ordinary drop methods of measuring interfacial tension are inapplicable. It is indicated that the results obtained give information regarding the state of deterioration and the probable performance of the oils when in use.—M. B. R.

The Corrections to be Applied to the Platinum Scale of Temperature. F. E. Hoare, Jl. Sci. Insts., March, 1929, pp. 99-102.

A table showing the corrections to be applied to the platinum scale temperature to convert to gas scale temperature is given.—M. B. R.

The Measurement of Axial Aberrations of Telescopic Systems of Small Magnification. B. Mourashkinsky & M. Savostianoff, Trans. Opt. Soc., Vol. XXX, 1928-29, pp. 49-67.

This work gives a method for the measurement of axial aberrations (spherical and chromatic) of a telescopic system of small magnification. The arrangements used in measuring axial aberrations are described. The method of measurement consisted in getting two out of focus photographs of a slit or pinhole placed in the focus of a collimating object-glass and illuminated by monochromatic light. The aberrations of a number of binocular telescopes were measured to test this method. The results of the measurements for three telescopes are given in the paper.—M. B. R.

Testing of Materials and Car Parts. C. A. McGroder, Iron Age, March 28, 1929, pp. 876-878.

The machines in the Chrysler Engineering Department for testing shock, torsion and bursting are described.—Ha.

An Electrical Test for Tin Coating on Copper Wire. H. M. Larsen and C. M. Underwood, Wire & Wire Products, April, 1929, pp. 118-119, 140.

This article describes a rapid, inexpensive and accurate method which has many advantages over the chemical test for determining the amount of deposit.—M. B. R.

Making Bismuth Wire by the Extrusion Process. D. C. Stockbarger, Wire & Wire Products, April, 1929, pp. 123-139.

Reprinted from the Journal of the Optical Society of America and Review of Scientific Instruments. Describes a method for forming wire fro mthis metal, which cannot be drawn.—M. B. R.

Portable Rebate Meter. (Tragbare Verguctungszachler). El Zeitschrift, March 7, 1929, p. 355.

To induce more wide spread use of domestic electric appliances during times of light load this meter is installed in homes and registers the consumption of appliances for which a special rebate is given.—Ha.

Recent Installations of Remote Metering Equipment. (Neuere Ausfuehrungen von Fernmessenlagen). W. Stern, El. Zeits, March 7, 1929, pp. 351-353.

Description of equipment which permits the transmission of many instrument readings to a central observation station in a large power system over only two transmission wires whereby the receiving end can choose between individual and group readings.—Ha.

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INSTRUMENTS, Vol. 2, No. 6, June, 1929, pp. 195-202, 2 figs.

A very complete report of the various instrument company exhibits.

ELECTRICAL INSTRUMENTS IN THE CHEMICAL INDUSTRIES.

B. P. ROMAINE, INSTRUMENTS, Vol. 2, No. 6, June, 1929, pp. 203-208.

The various electrical instruments and their applications in chemistry are discussed.
This paper was read before the Students' Course at the Twelfth Exposition of Chemical Industries.

CONDUCTIVITY AND HYDROGEN ION MEASUREMENTS.

W. N. GREER, INSTRUMENTS, Vol. 2, No. 6, June, 1929, pp. 209-212, 6 figs.

This paper was read before the Students' Course at Twelfth Exposition of Chemical Industries.
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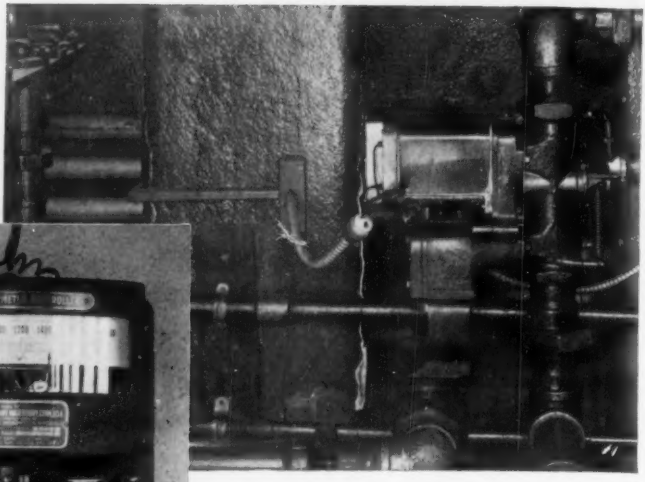

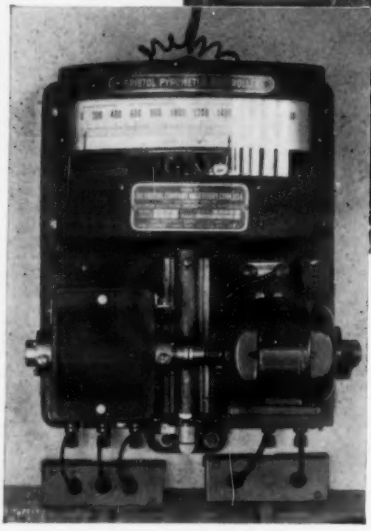

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